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CONTENTS

The School Shop

How Do You Interpret Industrial Arts?, *by William E. Warner*.. 33

What Others Are Doing

The Industrial Laboratory, *by A. C. Tagg and Leslie E. Wagner* 35
Machine-Shop Apprentice Training, *by Rowland L. Hill*..... 41
Accommodating the Larger Class, *by Harry J. McStay*..... 45

Special Shop Classes

Vocational Education in Reformatory, *by R. M. Kindred*..... 48
Shopwork for the Special Class, *by Kenneth R. LaVoy*..... 53
Education for the Subnormal Boy, *by Paul L. Caulwell*..... 54

Shop Management

Controlling Theft in the School Shop, *by E. L. Southard, V. J. Lockett, and M. M. Black*..... 55
Reading of Trade Magazines in School Shops, *by William J. Patlow* 58

School Shop Safety

Woodworking Machinery and Safety, *by Axel J. Kise*..... 60

Shop Layouts

Woodshop — Electric Shop — Sheet-Metal Shop — Farm Shop..67, 68

Shop Courses

Course in Electricity for the Junior High School, *by Tilden Collar* 69

Equipment and Supply Lists

Woodworking	8A	Automotive	35A
Printshop	22A	Drafting	46A
Metal-Working	27A	Electrical	46A

Our Supplement

Artistic Wrought-Iron Work — IV, No. 323, *by C. Weiler and Karl Ufer*..... 34A
That Confusing "Side View" Again, *by F. R. Kepler*..... 38A

School-Shop Equipment News..... 40A

BRUCE'S SCHOOL SHOP ANNUAL

The 1936 February issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION again brings the Bruce's School Shop Annual to its readers.

As in previous years, the content of the Annual has been chosen with greatest care. The question of the planning, equipping, and conducting of the school shop is not only of direct interest to the superintendent of schools, to the supervisors and directors of industrial arts and vocational education, but it must also be, and is, of grave concern to every earnest shop teacher as well.

It is for this reason that the Annual fits so admirably into the 12 issues which make up the yearly contribution of the INDUSTRIAL ARTS AND VOCATIONAL EDUCATION Magazine to the cause of practical shop training in the public schools of America.

While the inclusion of the Annual into a regular issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION has made it impossible to include more than a small part of the usual monthly offering of problems and projects, nevertheless, this shortage is more than compensated for by the professional articles written by men of note that have been made part of this issue.

It is hoped that this year's Annual will be found as helpful as its predecessors, and that the subject matter and the equipment, material, and supply lists which it brings to the reader will help in advancing the cause of industrial arts and vocational education in this country.

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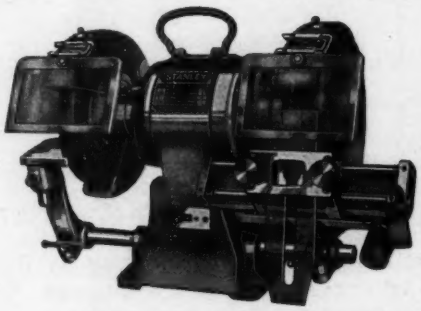
Stanley Electric Tool Division

THE STANLEY WORKS
Educational Department, New Britain, Connecticut

Stanley Portable Electric Tools



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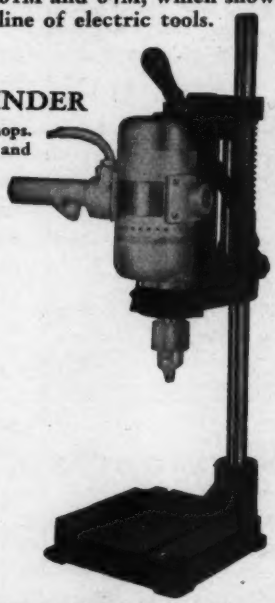

ELECTRIC DRILL NO. 121

½" Standard Duty Tool, very powerful, popular for heavy drilling. Universal motor mounted on oil sealed bearings, strong aluminum alloy housing, automatic safety switch, built-in drill gauge and "can't-lose" chuck key.

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This ¼" Heavy Duty Drill has all the features of the biggest Stanley drills. The straightline housing permits close work in corners or against walls.

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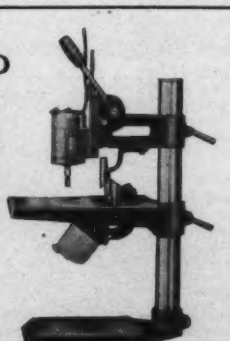


"Stanley Equipment Is Standard Equipment"

STANLEY ELECTRIC TOOL DIVISION, Educational Department, Elm St., New Britain, Conn.

How Do You Interpret Industrial Arts?

William E. Warner

Ohio State University,
Columbus, Ohio

The writer points out important facts about the past, the present, and the future of industrial-arts work in our schools, and then confronts the shop teacher with the blunt question "What about it?"

It is almost trite to suggest that the schools of today should be vitally concerned with the type of civilization in which they find themselves. If society were suddenly to discover itself without any schools and without any precedents, the schools which would be speedily organized would obviously take their pattern from the times, and that means from a highly developed *industrial* civilization. As one delves into the past, he is early struck by the fact that great civilizations have been produced by those people who have coped most successfully with their environments. It is with thoughts such as these that industrial-arts teachers of the nation should face their profession today.

Industrial arts as a school subject has had its greatest development thus far on secondary-school levels. Here it has passed through two somewhat well-defined periods of professional growth and is now in the midst of a third. The first was "Manual Training," where the emphasis was on *hand* skill, chiefly in woodworking. The second was "Manual Arts," where the emphasis, while still on skill, was extended to include the making of both *useful* and *well-designed* articles. The third is now "Industrial Arts," where the intent is to include all of the old that was good, and considerably more, to meet certain basic needs and interests of everyone in an industrial civilization, regardless of his age, race, sex, intelligence, or social status. Now this last is a large order, but the very nature of the time indicates the complexity as well as the importance of the problem at hand and suggests certain approaches to its solution.

The new Federal bulletin in preparation, on *Interpreting Industrial Arts*, will indicate in its opening chapter certain "Origins and Functions" of the program with which everyone should be familiar. The *Ohio Prospectus*, published in 1934, identified certain important "antecedents" which serve as bases both for *developing* and for *evaluating* industrial-arts programs. These involve: (1) current *social-economic forces* which describe present-day civilization, (2) *material cultures* of other times which have endured because of their beauty and utility, (3) the *nature of the individual and his needs*, in addition to a few points from (4) *a rich professional heritage* which is surprisingly old but vitally important, because it is so much a part of human life.

Suggestions for Content from the Social-Economic Order

The industrial-arts program is intimately concerned with interpreting an amazingly complex industrial development. Inventors are patenting 35 times as many things in equivalent periods today as they did even 50 years ago. If this means nothing else, it should be evident that the school-shop program of one and two generations ago will not suffice today.

The population of the United States has increased 65 per cent since 1900, while the quantity of manufactures increased 151 per cent in that time. Another interesting fact is the greater variety of family possessions from house to house than was found in any previous era in man's history. The consumer problem alone is one of selection to a degree never before experienced. With rising standards of living, methods of high-pressure salesmanship, installment buying, improved techniques of advertising and merchandising, and continual changes in styles, the schools—particularly the many practical-arts subjects, including all phases of industrial arts and homemaking—are faced with a myriad of problems which one writer refers to as dealing with *consumer-literacy*.

We spend seventeen billions annually for food, eight billions for clothing, six and a half billions on automobiles, and four billions for home furnishings. How can any program of public education be consistent if such points are not included as basic subject-matter experiences for all children? The joker lies, of course, in whether or not industrial-arts teachers are willing and ready to accept so provoking a challenge concerning the scope of what should be found in their programs.

Occupations change so rapidly nowadays that highly specialized training can no longer be justified in common-school programs through the senior high school. *Diversity* and *enrichment* more nearly describe the programs needed, and properly so when one reflects that nearly 70 per cent of the 18-year-olds are now in school, compared to 10 per cent 40 years ago. But there is hope, for Judd in a recent article noted an increase in that period of time from 9 to 49 *non*-academic types of offerings in American secondary-school programs.

Other Antecedents of Industrial Arts

From the standpoint of culture ascribed to the use of materials, the individual who has learned to know styles in furniture, glass, architecture, rugs, silverware, pottery, china, costume, and other items of common use is prepared to surround himself with those things which an integrated or cultured taste tells him can supply lifelong satisfaction. One who knows the various forces—racial, individual, symbolic, material, national, etc.—which have entered into the making of the common articles of everyday use, is stimulated constantly to fuller enjoyment of those things and is keenly interested in the source and direction of those forces. All this touches upon an important phase of industrial arts. Man is surrounded by *material cultures* of all ages, but what a mess he makes of their use. We interpret this as another too-long-neglected opportunity and function of industrial arts.

Appreciation of beauty of line and proportion and the developing of a knowledge of design should be stressed and experienced. Antiquity and the work of Oriental craftsmen have provided numerous examples which may be seen in museums and the better stores, and manufacturers are constantly striv-

ing to provide worthy designs. Pupils may be made conscious of these examples through pictures, displays, trips, and motion pictures. Co-operation between the industrial- and fine-arts departments in a school would do much to improve pupils' efforts in adapting old or creating new designs and probably improve the status of both areas.

When it comes to *the individual and his needs*, for another basic antecedent, many points or principles are discovered which virtually prescribe the school's program and particularly its methods. Dewey, for example, early pointed out the need for *activity* as the approach to all learning. Bonser enumerated *certain native impulses* which needed satisfaction in *manipulation, investigation, artistic expression,* and the like. Authors on adolescence point to certain natural conflicts and to certain very normal escapes, as well as to many physical and mental changes, where experiences in the fine and practical arts prove most necessary to a youngster's development. One is early forced to conclude from such points that learning through activity is the natural way to learn and not just a method to be employed with subnormals. On the other hand, the formation of certain desirable habits, attitudes, and appreciations; the development of enduring, healthful, and educative interests, can come so easily through experiences in the arts at these ages.

Industrial Arts in Elementary Schools

Programs in the *lower primary* grades deal principally with the immediate environment of the child. Bonser classifies the subject matter of industrial arts in the elementary school under foods, clothing, tools and machines, shelter, records, and utensils. Activity programs in the *third and fourth* grades introduce the lives and works of other peoples. Geography and history abound in industrial-arts programs so rich in integrational possibilities as does an introduction to physical, biological, and social sciences. All of these, however, are based upon an activity or experiencing basis where the rich possibilities of industrial arts are so broadly applicable to useful learning.

Programs in the *fifth and sixth* grades introduce vocational, scientific, and economic contacts and problems pertaining to a complex industrial civilization. Principles like these serve as guides for developing industrial arts or "integrated activity" programs in the elementary schools. But, the reader should ask, all this is very well and good, but what should the schools do about it? It is or should be easy to list hundreds of units or studies to achieve principles like those identified above. Here is a most neglected phase of industrial arts and, more important still, of elementary education. Many leading cities are gradually introducing it as an integral part of their programs.

Industrial Arts in Secondary Schools

Many would separate this section into junior- and senior-high-school levels and restrict it to boys. Even a cursory analysis of the origins and functions of industrial arts, however, will point to the error of such a procedure. The secondary school strives, on the one hand, to introduce industry, and on the other, to provide for an amazing array of individual interests for all pupils, some of which should develop into worth-while hobbies but all of which should show some value of immediate concern to the individual in question.

Objectives of "Exploration," "Avocation," and "Intelligent consumption" pretty well define the principal scope of industrial arts in the secondary school, large or small. There are other objectives, of course, and the points of emphasis will vary, but these three will or should dominate any program. Many hold that the program of the seventh and eighth grades should be rather formal, providing introductory experiences in a wide range of industrial materials, processes, tools, and machines. Much work of this type in the school today is still too narrow, however, and leaders now find themselves committed to a broad program of enrichment, with the development of as much integration as possible.

Areas or types of industrial-arts content deemed basic in the secondary school to meet the requirements of the antecedents described earlier will include: drawing or planning (sometimes narrowly referred to in this connection as engineering, mechanical, or instrumental drawing); graphic arts (too frequently limited to letter-press printing); ceramics (if it is not restricted to the industry referred to as *art pottery*); wood and metal industries; transportation, including automotives and aviation; communication, including electrical service, lighting, telegraphy, and radio; along with textiles, including clothing studies and weaving; foods from the consumer as well as the producer angle; along with certain minor areas such as some of the commoner arts and crafts as leather tooling, all of which the general philosophy presented above would require if applied.

Permit me to be more explicit by reviewing that in the drawing and planning area of a secondary school's *laboratory of industries* the problems should include, according to Hauenstein of the Ohio committee, experiences dealing with layouts, lettering, shape description, pictorial drawing, descriptive drawing, color, design, working drawings or plans including furniture and architectural drawing, duplicating, map drawing, charts and graphs, block printing, commercial art, etching, chalk talking, and cartooning.

The graphic-arts area needs to include units of experiences dealing with papermaking, stationery, cards, forms, tickets, illustrations, posters, programs, color usage, bookmaking, newspapers — all of which should include not only traditional letter-press printing but planographic and intaglio as well, to be consistent with the principle of exploration, to say nothing of the others.

The woods area includes experiences dealing with carpentry and building, including simple bench experiences; furniture and furnishings, including style; patternmaking; finishing and upholstering; wood identification; forestry and conservation; lumbering, along with pursuits characterized as arts and crafts or hobbies. The *Ohio Prospectus* deals more in detail with the scope of industrial arts in the secondary school as will the new Federal *Interpretation* bulletin referred to earlier.

Industrial arts becomes even more rich in content and varied in application in the upper grades of the secondary school period. Many have not held this view, either because the programs were undeveloped, pupils were concerned with restricted academic qualifications for college entrance, or even more restricted programs of specialized trade training introduced for a few on the assumption that they actually would prepare adequately for entrance upon and continuance in a trade. With an involved technology, however, this pattern has changed and one sees an emphasis on comprehensive and extended industrial-arts programs followed by technical programs in some secondary schools, which are followed in turn by the specific trade training which many now favor, starting at age 18.

Reflecting back to the earlier part of this article, it would seem that any phase of the industrial-arts program could be *evaluated* in a school or community by considering its ability

to touch on the *extent* of American industry (exploration), to provide experiences for a worth-while leisure (avocational interests), to develop more intelligent consumption (consumer knowledges and appreciations), to provoke individual growth (personal-social trait development), to cultivate the aesthetic or artistic side of life, and to find out about the occupational realm, a side of an economic society so important to everyone. Surely it is not possible to conceive of a more fundamental or useful phase of education than this interpretation of industrial arts if modern-day educational leadership is truly concerned with developing a great citizenship in a great civilization.

The above reviews but a part of one writer's interpretation of industrial arts. The important thing seems to be for every teacher in the profession to have a sound basis for what he does and then demonstrate it to others by word and by deed. Someone has referred to all of this as *educational statesmanship*. What about it?

WHAT OTHERS ARE DOING

The Industrial Laboratory

A. C. Tagg
Director of Industrial Education, Dearborn, Michigan

Leslie E. Wagner
Instructor, Fordson Public Schools, Dearborn, Michigan

The experiences at Dearborn may help other communities solve their trade-training problems in an equally satisfactory manner.

"Industrial Lab" is the name we have applied to a one-year, 200-hour course of general *trade-training* facts and experiences. This course is *required* of all students enrolled in our Smith-Hughes trade courses. Other high-school students may elect a similar course in the same shop if a sufficient number elect the work to make a separate class possible.

The aim and objective of this course is to broaden the student's industrial knowledge and work experiences and to aid him in finding his first employment in industry. Emphasis is placed upon handwork, and the shop is equipped with a minimum of power-driven machinery. The only power equipment furnished is a band slitting saw, some grinders, an electric drill and stand, a universal lathe, some buffers, an 8-station acetylene manifold, an electric-arc welder (200 amp.), and a gas furnace (for foundry practice).

In addition, the usual bench and layout facilities for both heavy and light metal work are included.

The course is not offered as a substitute for specific trade training but rather as a supplement to such trade courses as auto mechanics, machine shop, electricity, etc.

The industrial-lab course comprises the following industrial trade activities: *Hot metals:* Forge, heat treatment, welding, foundry practice (elementary); *Cold metals:* Grinding, buffing, polishing, chipping, filing, drilling, sawing, fitting, riveting, metal fabrication (heavy and light), musical-instrument repair, general benchwork. Plating is planned and will be incorporated as soon as possible.

In carrying on the work activities of the course, we rely upon production jobs originating within the various school departments. We make our own small tools, including hack-saw frames, screw drivers, chisels, plane handles and knobs, gas furnaces, and other equipment.

The maintenance and industrial departments furnish miscellaneous work in welding, heat treatment, fabrication, structural steel for building alterations, sheet metal, buffing, elementary foundry practice, and the like.

There are many advantages in using production jobs rather than projects. First, a large variety of job work is brought to the shop, and secondly, the standard of accuracy, correct details of specifications must meet the required needs. A contracted time limit is set upon each job and the economy and efficiency gained from organization and planning help to enrich the course.

Student groups are rotated through all divisions of the lecture and work experiences of the course. A carefully organized plan of foremanship, job analysis, time allotment, and records, has been worked out by Leslie E. Wagner, the instructor.

Practical industrial science is a related part of the course and is emphasized and correlated with the chemistry and physics department of the school.

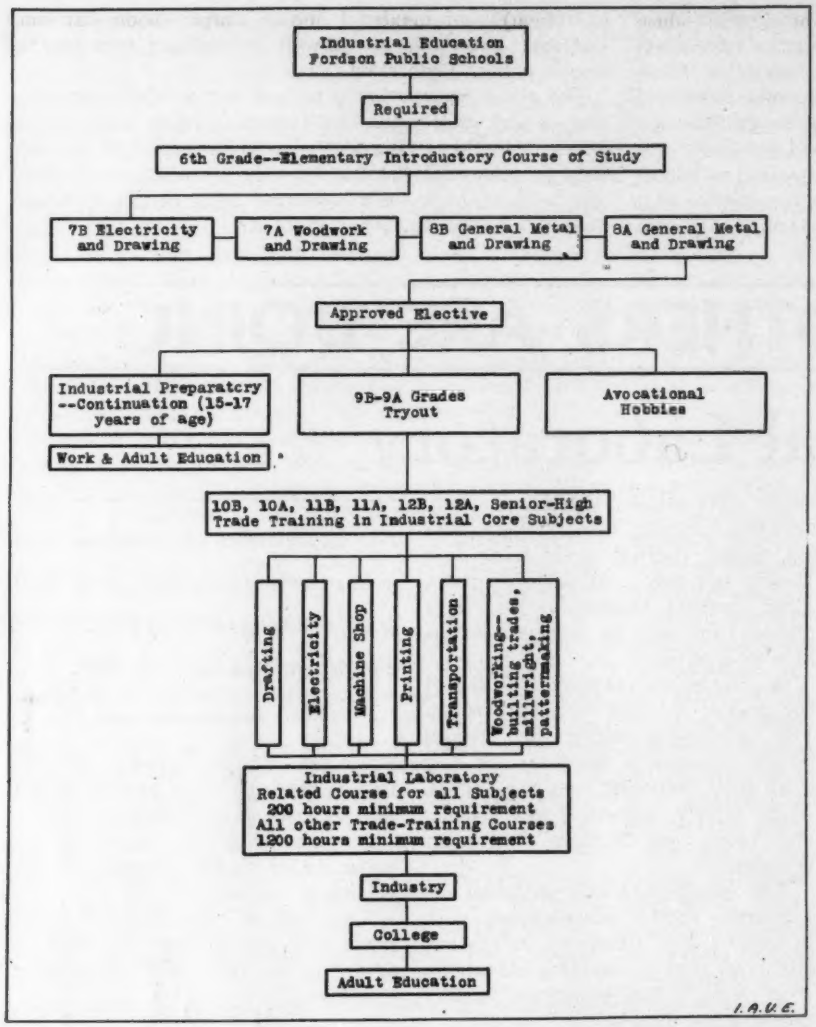
Work orders are written in the business office for all jobs. The supplies are ordered from the supply room as needed and a complete job record of cost and time is kept. This is a part of the student's foremanship training also.

The qualification of the teacher is a major factor in the planning and executing of the course.

The work is required in the 11th grade and the students are classified according to their high-school-course enrollment.

Industrial Laboratory

The most trying question confronting educators in the field of vocational training is how better to aid the young worker in entering and adjusting himself to industrial life. This is a problem that challenges the whole cycle of trade training. Shall greater emphasis be placed upon related subjects, and if so, will they aid the vocationally trained student in growth and adjustment? Shall we spend less time in the development of skills and specific trade-training units, such as machine shop, electricity, etc., and offer in its place a more diversified and general type of industrial training of vocational nature, or does the problem lie in still a different field? Are we wise in assuming that specific trade training belongs to the older age levels and should therefore be taught in the postgraduate field only (age levels 18–21)? The debate of these theories will not bring a dependable, early answer.



It is our belief that there is at this time a middle-ground position that is conservative, safe, and beneficial to the trade-training student of high-school age.[1] The following comprises our plan and expresses our theories relative to these questions: (1) We believe that industrial or vocational education demands prerequisite *education and training* in the same proportion as any other school curriculum that prepares for a choice of lifework. We, therefore, believe that the prerequisite training should begin in the elementary school (fifth or sixth grade) and continue through the junior-high-school level as try-out and finding work and that units of activity analyzing the industrial activities of the community and district shall be a guide in building the curriculum.

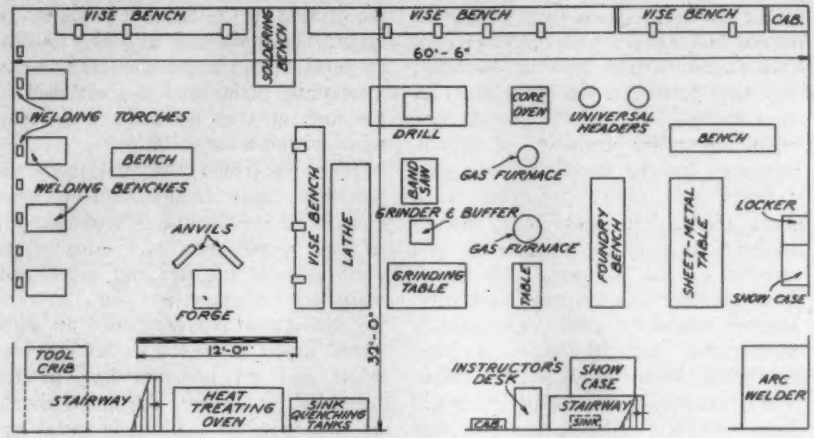
Time allotment, equipment, and qualified teachers are essential qualities in this field of education as in other divisions. Through this level of prerequisite work, students and subject matter shall both be considered as part of the regular school, and that the work be not looked upon as a special subject. In senior high school there shall be a definite choice of trade training which must be made practical and that high standards be maintained. Individual counseling and guidance shall accompany this training together with general informational civic and history courses, related scientific and mathematical courses, and the usual required academic work of the high school. Our aim is to graduate each high-school student taking the industrial course, with the specific purpose of entering industry and continuing his training and education to the status of a journeyman worker or other industrial position. We believe that higher education in the industrial field is of value only when it is accompanied by practical experience, and that it is far better for the student to pay his own way, thereby knowing the joy of independence and accomplishment (co-operative plans of education).

It is the opinion of many educators that specific trade training should be offered in the latter years of high school or early college period only because of two prime factors: (1) time allotment required for Smith-Hughes courses, and (2) the ever rising age entrance into hazardous occupations and trades. Training for industry demands a choice between two major activities: first, skilled knowledge in a specific trade activity or divisions of industry, or, second, semi- or general skills and related knowledge for general work. There has always been a difference of opinion among public-school educators in the field of vocational and avocational education as to which was most important and which should receive the emphasis.

Because of the nature of the Smith-Hughes Law and its accompanying state law, *trade training* taught by a journeyman teacher has received the emphasis in vocational education. This does not discredit, however, the value of avocational work but simply emphasizes the difference in their aims. It goes back to the first point, however, of prerequisite requirements. It is our theory that training in a specific skilled activity together with its related knowledge is similar to training in any activity which proposes to develop skill and precision. Music and art are good parallel examples. If skilled manipulations are not practiced during the plastic age levels, it is probable that the individual will not develop the technique and precision necessary for high quality of achievement regardless of interest at a later date. This is the outstanding difference between the American plan and the European plan of education in the field of vocational work. Now that the United States is denied the opportunity of importing skilled workers, it must develop them among its own citizenry. This change in American policies emphasizes the necessity for analyzing carefully the questions raised.

Individual characteristics and industrial case problems formulate social problems which need to be taught in the public schools. We should make an effort, therefore, to establish, if possible, minimums and maximums of time allotment for both trade training and related

[1]Snedden, *School and Society*, February, 1935, issue.



Shop layout

subjects guided by age levels rather than grade levels. Legal entrance into industry is dependent upon age rather than grade levels. We believe that modern industry has reached a point of efficiency in scientific research and development which demands related subject knowledge equal to the skill and precision of the trades.

Public-school curriculum approach to these problems must recognize *related-subject training*[2] begins at an early grade level and it must have a liberal interpretation and background of industrial fact.

Our social-studies curriculum should recognize collective bargaining, master skills, semiskilled and unskilled laborers, employment adjustment, tenure of office, distribution of labor and time allotment for working periods. They are social problems which affect all society and belong to all students of the public school with emphasis upon the industrial divisions. Mathematics should have the practical interpretation of industrial practices. Vocabularies in the field of English should include industrial terminology. American public schools must meet the changing social order by offering a very usable and practical curriculum for all students up to and through the age of 18 years.

Shall trade-training emphasis be placed upon postgraduate students or senior-high-school students? First of all, this problem belongs to the field of economics affecting the individual, the home, industry, and society. It is true that throughout the depression the great army of young unemployed boys and girls has formed a real problem in our social order. We have always had trouble adjusting young people from school to work. Observations gathered over 25 years of teaching have led to the belief that most young people are torn between two desires at approximately the age of 18 or the time of high-school graduation. They are desirous of becoming self-supporting and ambitious to apply their abilities. Through the influence of academic courses in high school, they have shaped their desires and training toward nonskilled jobs. It is difficult for them to understand that school life is different from that of employment, and they do not know that industry employs the larger percentages of the American people. They are not well informed of the meaning of service — service to themselves, to their families, and to their neighbors. They do not know their moral and spiritual obligations to society. They do not know that productiveness is a service to society, and that this productiveness is the proud heritage of the American people which has made our country the leading manufacturing nation of the world.

To eliminate trade training from the high-school level and to place it in the postgraduate level is to leave out of the picture the social and economic problems of the young worker. It also disregards the factor of training to be received in the *practical field* in the environment of work for remuneration, and it ignores the advisability of development of skills during the plastic years of junior- and senior-high-school age.

Industrial leaders are offering young people a great service in this activity, and we, as educators, must co-operate to the best of our ability. We believe that trade training should be emphasized in the 11th and 12th grades of senior high school. In cases of students graduating under 18 years of age, additional training should be extended to one year of postgraduate work. Too much emphasis cannot be placed upon guidance, counseling, related information of trade and industrial nature, the economic benefits to both the individual and society and the need for co-operation of the home and the industry in this problem of trade training, and of the adjustment of the youth to life situations.

Outline of the Industrial-Lab Course

"The industrial lab" is the name given to a *related trade-training* course of study in the Smith-Hughes division of the industrial field of education. As indicated by the title, it offers general trade information and skill in many metal-working activities thereby making it easier for the high-school graduate to enter industry and successfully do work even though there is no immediate opening in his trade specialty. It is a dependent course of study requiring training in some one of the Smith-Hughes trade-training courses. It aims to acquaint the student with general information, scientific facts, industrial procedures, safety education, shop management and organization in many activities of industry.

Curriculum

As indicated in the foregoing, the curriculum should be very broad and dependent upon the needs of the section of the country in which the course is to be offered. With this thought in mind, we have confined our industrial-lab curriculum to the metal-working field of industry. It does not greatly differ from a general shop in physical arrangements. It is different, however, in its aim and objective.

All trade students (Smith-Hughes) are required to take this course of study. These students have a background of try-out and finding work taken in the junior high school and one year of specific trade training in their senior-high-school specialty. They will have developed certain skills and acquired trade information which will make their progress in these new activities more rapid and more easily assimilated.

We have picked the following units to comprise the curriculum: tool forging; forming in an open fire; heat treating with modern heat-treating equipment; acetylene welding and cutting; and arc welding; bench metal consisting of hand work with hammer and chisel; drilling, hack-sawing, scraping,

[2]Industrial Arts, Social Studies, General Science, Industrial Information.

forming, etc. The two preceding divisions comprise a new feature in industry — fabrication with lighter sheet metal, plating, buffing, and foundry practice in soft metal and metal patternmaking.

These divisions have been chosen because they represent the major activities which lend their influence to the formation of the foregoing outline and can be spoken of as aiding in social adjustment of the individual in employment. We cannot be sure that a student specializing in a specific trade will have an opportunity to enter upon work in this trade activity upon graduation. It is, therefore, socially necessary that a broader possibility for industrial adjustment through those early years of employment and completion of apprenticeship be provided.

We find that many students specializing in electricity, auto mechanics, etc., have had opportunities to gain employment as welders because of their experience in the industrial lab. It is not our hope that they will remain welders but rather that through this contact and experience they may adjust themselves to the trade for which they have been trained and have a preference. If they have no adjustment training, however, they may be denied the opportunity to enter industry for a long period after completing their training in school. Instances can be cited of very good students who have specialized in a given trade, but who have entered industry through the experiences and training of the industrial lab rather than through their trade specialty. Many educators will immediately assume that there is little or no need for specific trade training if the industrial-lab curriculum and experiences will allow entrance. This is, however, not true. It is the background of specific trade training with its high requirements and precision, related information and trade technique, and skill of craftsmanship which makes of the individual a good workman. The industrial lab will fail without this background of specific trade training as preparation for entrance into industry.

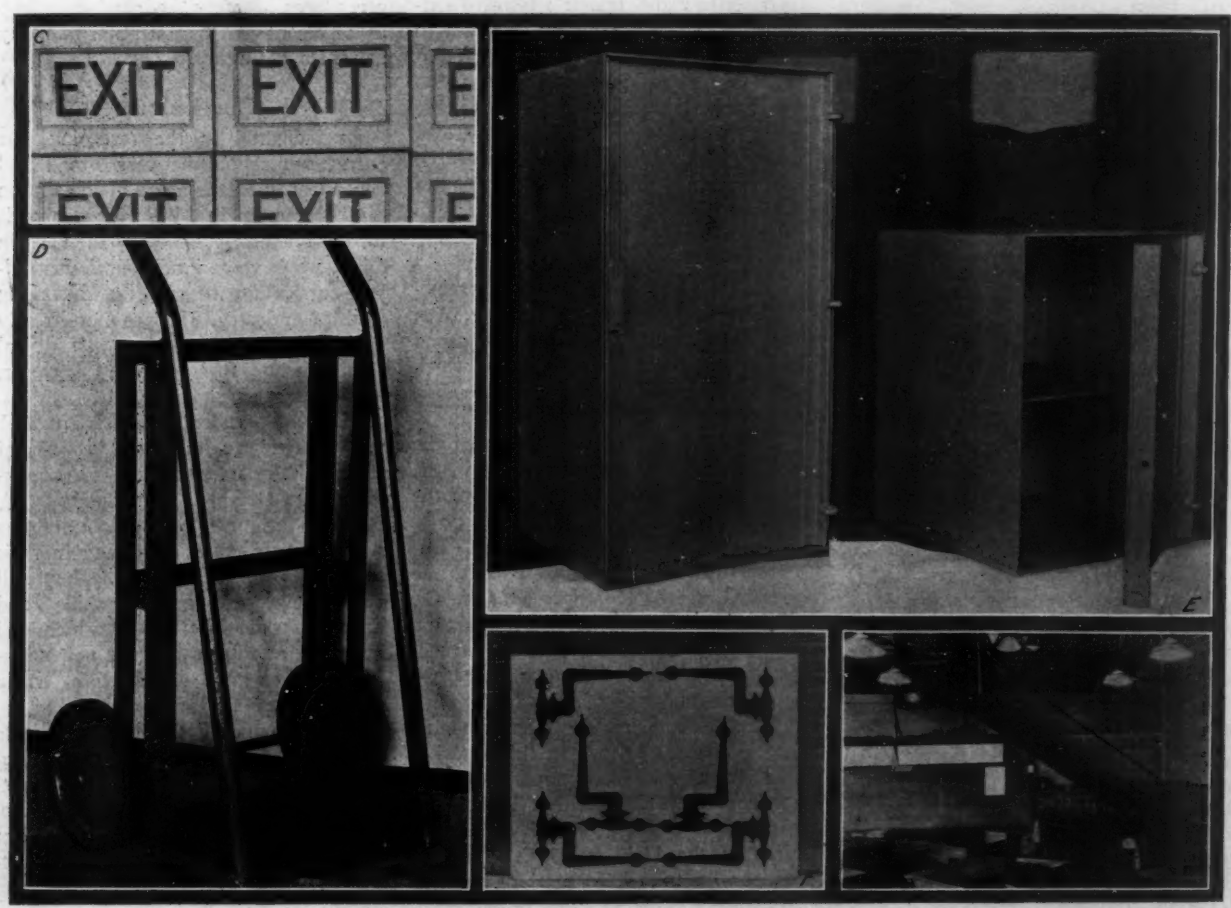
Thus a musician may start his or her training early in life and through constant practice, study, and careful recognition of technique becomes an artist. The individual with less musical preparation and a late start may receive avocational value and a great deal of pleasure but does not acquire the command of the artist.

It is our belief that the industrial revolution has brought about more changes in the social and economic life of our people than any other single factor. Trade training and apprenticeships are necessary, but our fast-moving civilization has demanded an additional broad education, a larger viewpoint and an understanding of the necessity for change. Education should be well in advance of these social and economic necessities of our industrial life. It is with this thought in mind that we have formulated the industrial-lab course of study as a supplement to and as a required one-year course of study within our Smith-Hughes trade-training division.

Related Shopwork

Forging

1. Fundamental principles of forging
   a) Constructing proper fire



Various jobs produced in the industrial laboratory

b) Tool operations — drawing, bending, upsetting, etc.
2. Essentials in tool forging of steels
a) Heats required for working
b) Grain formation — structure and value
c) Eliminating strains
3. Working steel in the Alpha, Beta, and Gamma stages
a) Heat and grain analysis in these stages
4. Sparks list analysis and identification for ferrous metals plus alloys

Heat Treatment

1. The development and refining of ferrous metals
a) Smelting of iron ore — various furnace methods used for refining
b) Value of the addition of alloys to ferrous metals
c) Purpose and reaction of nickel, chromium, vanadium, manganese, and silicon in steels, etc.
2. Object of heat treatment:
Scientific analysis of grain crystallization and movement within the steel during various heat-treating processes. Examples: Pearlite, Austenite, Cementite, Cartensite, etc.
3. Effect upon the structure by mechanical working of steel
4. Methods of finding thermal critical range
a) Magnet
b) Color
c) Pyrometer
d) Influence of quenching
(1) Quenching methods
(*a*) Oil
(*b*) Water
5. Annealing
a) Principles
b) Operation
c) Value
6. Hardening
a) Oil and water quenching
b) Principles involved — how done
c) Visual and pyrometer method
d) Rockwell and Brisell Tests
7. Tempering or drawing
a) Visual and scientific method
8. Casehardening and carbonizing
a) Various commercial methods
9. Normalizing

Foundry Work

1. Foundry tools and terms
a) Tempering and cutting the same
b) Kinds of sand — purpose and use of each
c) Mold construction — parts of mold
d) Melting and casting nonferrous metals
e) Melting points of various metals
f) Effect and importance of various alloy combinations of ferrous and nonferrous metals
g) Purpose and construction of cores
h) The study of castings and construction as used in the correlated trades of the laboratory course

Welding

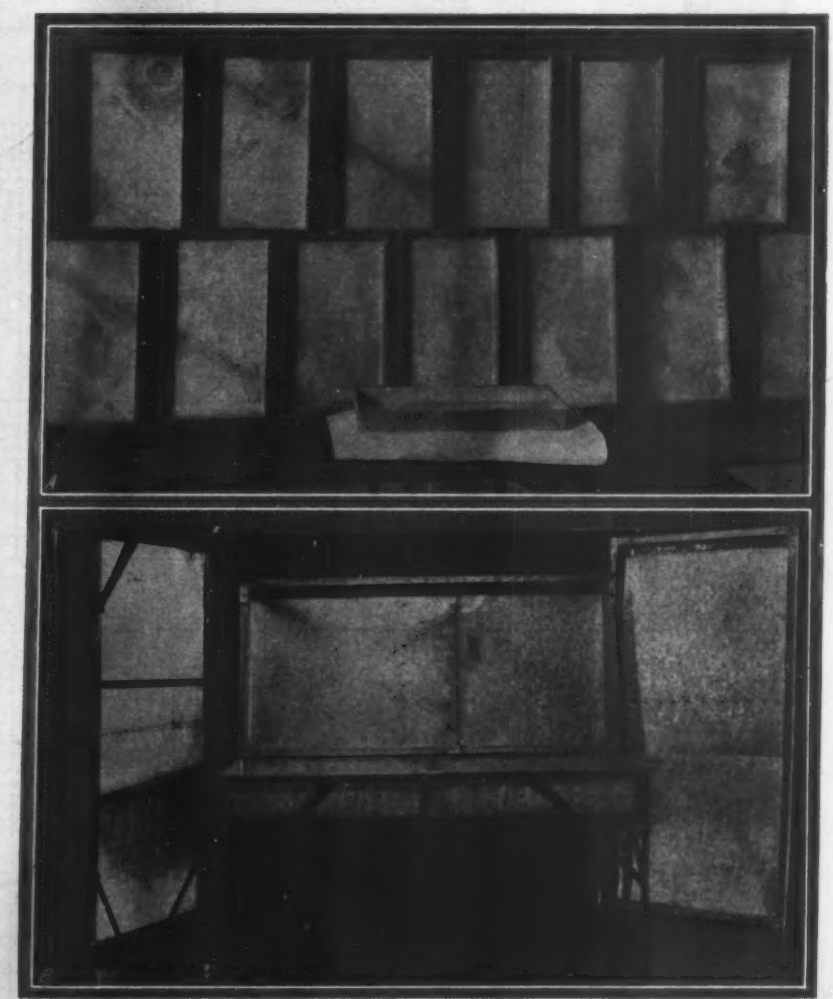
1. Oxyacetylene process
a) Welding principles and factors of ferrous and nonferrous metals
b) Welding preparations and layouts
c) Welding alloyed steel
d) Brazing ferrous and nonferrous metals
e) Welding pipe — various pipe layouts
f) Gas cutting or burning, hand method — frame cutting and riveting
2. Electric process — arc welding
a) Principles — voltage, polarity, amperage
b) Various forms of welding; fillet, butt, etc.
c) Arc welding various alloy steel
d) Line welding and spot welding

Fabrication of Metals

1. Light gauge
a) Study any operation of sheet-metal-forming tools, for example: slip roll former, universal header, wiring, burring, bar folder, brake, grooving
b) Blueprint interpretation of layouts
c) Sheet-metal construction — job work
d) Soldering, riveting, lock seaming
e) Forming presses and dies — chassis and body development
2. Heavy Metals
a) Layout — tools, etc. Blueprint interpretation
b) Cutting — gas, shearing, band sawing
c) Construction work, welding, riveting
d) Tensile strengths of various construction — steels and supporting members

Bench Metal Work

1. Filing — kinds of files
2. Chipping — types of chisels used and methods
3. Hack sawing — hand
4. Riveting
5. Drilling
6. Pipe cutting — threading, fitting
7. Pipe layouts
8. Tapping — threading by dies
9. Cold-metal bending — bending jigs and construction



Special jobs produced in the industrial laboratory

10. Metal forming
11. Grinding — offhand, portable shaft grinding
12. Blueprint layout work

Metal Finishing

1. Bumping
2. Grinding
3. Buffing
4. Polishing
5. Plating, nickel and chrome

Band-Instrument Work

1. Reconditioning Instruments
   a) New pads
   b) New corks
   c) New springs
   d) Straighten slides, keys
   e) Bumping out dents
   f) Polishing
   g) Adjusting instrument

Production Work Procedure

The industrial-lab course of study is dependent upon work requested by various departments of the school. It took considerable planning and organization to develop this method of organization and procedure. The variety of work was not, in the beginning, well distributed. This difficulty has been overcome and all the various divisions of the curriculum are receiving a profitable distribution of work. Illustrations of the foregoing are: (1) the steel cabinets constructed for the health-education department for storage of athletic equipment are a good illustration of fabrication types of work; (2) Exit signs cast in aluminum from metal patterns illustrate the foundry division of work; (3) Many small tools, such as cutters for the machine shop, chisels for the general metal department, etc., illustrate the procedure in heat treatment and tempering work. Each divisional activity specified in the curriculum is thus being supported by demands from various departments of the schools.

The following factors have contributed to the success of the course. Vigilance of the industrial department in selling the type of service which it can render, and the adjustment of it to our shop organization as a part of the course.

An administrative work-order procedure has been established which is as follows:

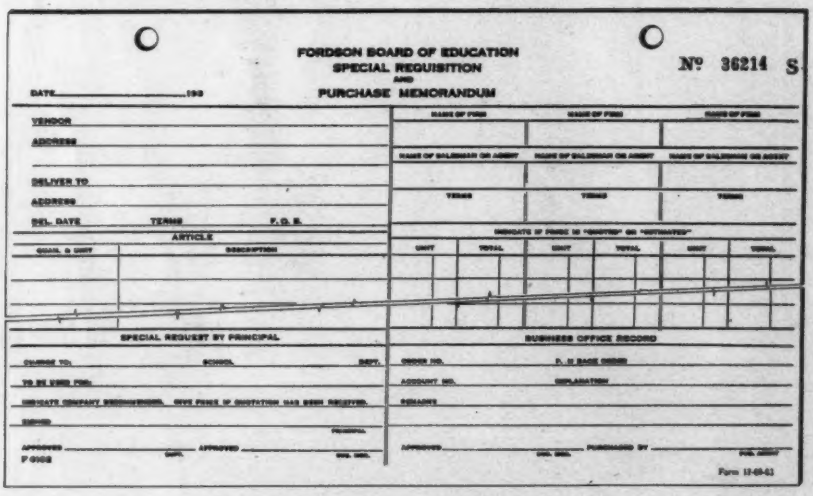


Fig. 1. Special work requisition

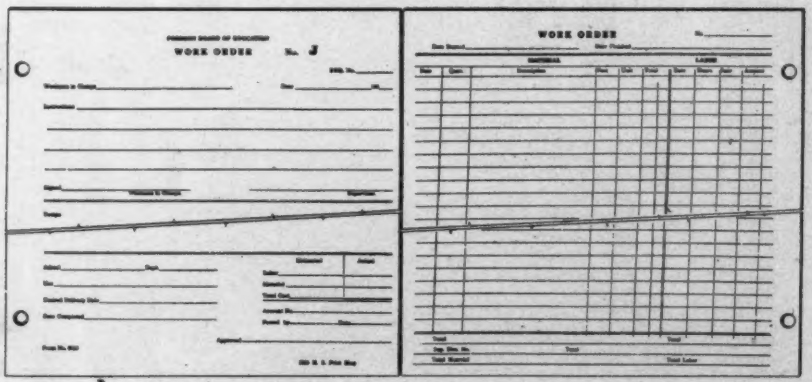


Fig. 2. Front and reverse sides of work order form

1. Work is accepted only upon analyzation of its educational quality and the difficulty of skill involved. (This is done by the director and with the advice of the instructor if necessary.)
2. Requisitions requesting work originate either within the industrial department or with administrators within the schools, such as principals, business manager, superintendent, maintenance, etc. (See special-requisitions form, Fig. 1.)
3. If the work is approved by the head of the department and the expenditure is approved by the superintendent and business manager, a work order is written. (See work-order form, Fig. 2.)
4. When the work order is received by the instructor, the requested job is analyzed for supplies, time allotment, and the nature of the work. The shop organization is then put in motion to carry out the order.

We have confined our shop activities to the subscribed curriculum for industrial lab as given in this article. The content of such a course would obviously depend upon local needs and the corresponding curriculum.

In the presentation of this plan emphasis has been placed upon the fact that the industrial-lab curriculum is a related course of study. Without the accompanying trade-training courses, together with their related academic subjects, we are quite sure the course would fail.

We do not claim that a student can be placed in industry and succeed on the basis of the 200 hours of training that is offered in this course. The work of the industrial lab together with the prerequisite junior high school and accompanying trade-training specialty is sufficient to assure the individual broad general industrial information. The course does offer, however, a much wider experience in both skilled activity and related information than our regular trade-training divisions and more of our students are able to enter various divisions of the large manufacturing plants of the Detroit metropolitan area than would otherwise be possible without this experience.

We have, for instance, placed many students in welding as a result of their industrial-lab training even though their specialty was that of auto mechanics, machine shop, electricity, or some other trade-training course. It is also gratifying to observe that these people will be adjusted into their regular trade course after several months' employment in the industry.

This course of study is becoming very popular with industrial workers in our division of adult education as a supplement to daily employment.

Machine-Shop Apprentice Training

Rowland L. Hill

Jacksonville Technical School, Jackson, Michigan

A description of the work done with candidates for apprenticeship and indentured apprentices at Jackson, Michigan.

During normal times there has been a fair supply of semiskilled specialists. However, there is always an actual scarcity of skilled, all-around craftsmen. These higher skilled men are not only indispensable in the shop, but from this group must come the majority of its foremen, superintendents and managers.

Serious thought must, therefore, be given to a type of training which will produce these skilled men, if we are to hold our leadership in vocational education.

To carry on this training, the Technical School of Jackson, Mich., has a course in machine-shop practice and apprentice training, the plan of which is presented in this article.

General Purpose of Shop Training

As a part of the general educational program, the course in machine-shop practice offers to the boys an opportunity to acquire manual skill and to learn the correlated technical and general subjects necessary to pursue successfully the machinist's trade.

To industry, at large, it means the securing of a supply of broadly trained, skillful, intelligent, and loyal artisans, who are capable of advancing with experience, into technical and managerial positions.

Part I — Machine-Shop Practice

Aim. The aim of the whole course, with its related work, is to carry each student as far along in the trade as is possible with the available equipment, the ability of the individual student and the time allotted.

Methods of Selecting Boys. The tryout period is for all beginners, with the

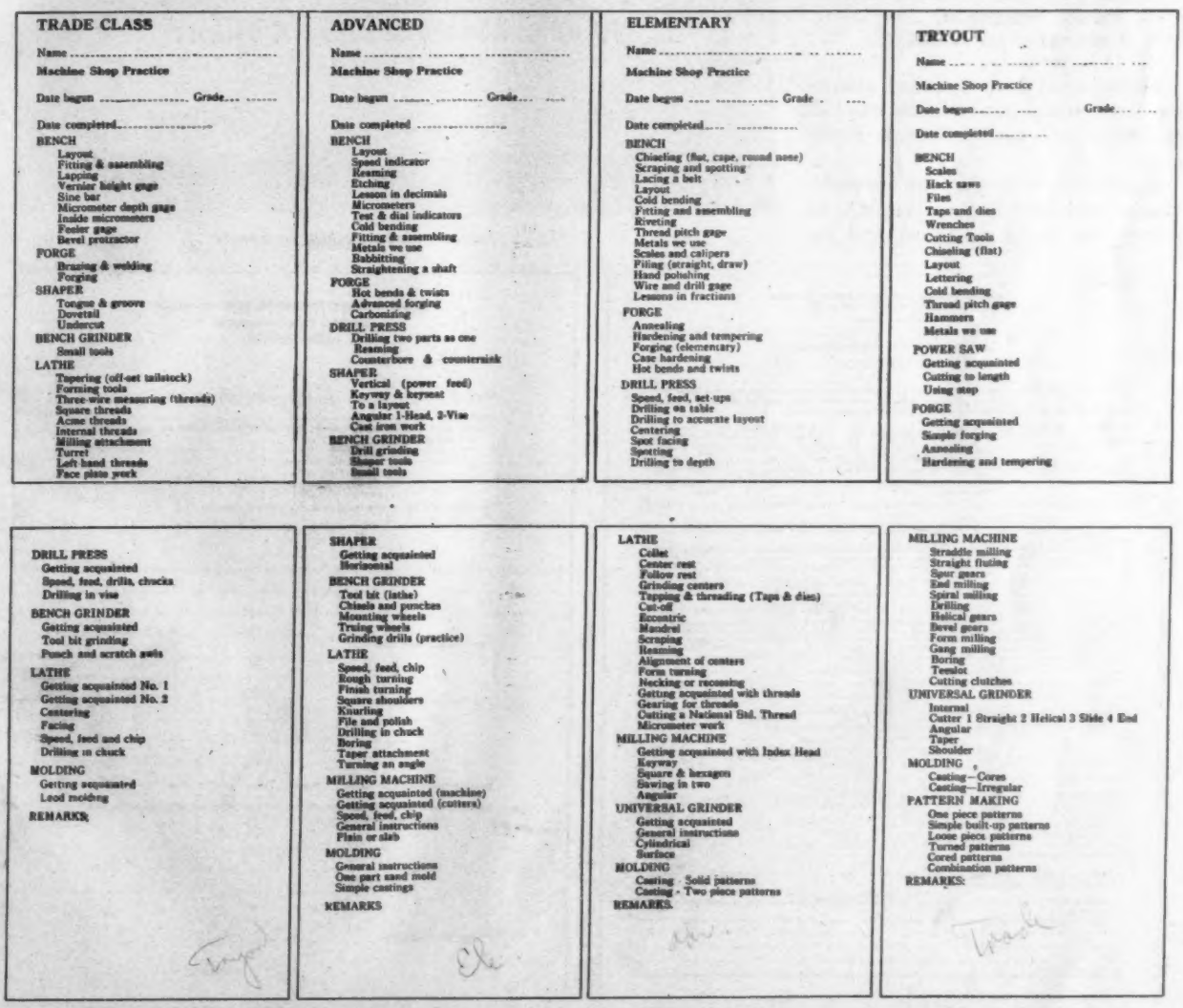


Fig. 1. Operation cards. Upper row shows the fronts of the cards, while the lower row shows their reverse sides

purpose of giving them in ten weeks' time, a general idea of what machine-shop work is like. Those who show exceptional ability and interest are encouraged to go on.

Length of Course. The average student should finish the following units of the course as follows: Tryout, 10 weeks; elementary, 40 weeks; advanced, 40 weeks; trade, 80 weeks. The tryout, elementary, and advanced groups have shop for 1½ hours a day, five days a week. The trade group have shop 3 hours a day, five days a week. A school year is 40 weeks.

School-Shop Equipment. The machine shop at the Technical School is equipped as follows:

4 11-in. South Bend lathes
3 13-in. South Bend lathes
1 No. 2 universal milling machine
1 17-in. shaper
1 Upright drill press
1 No. 2 universal toolroom grinder
1 Pedestal tool grinder
1 Combination gas furnace
1 12-in. power saw

All machines have necessary attachments and equipment to do the essential operations and have individual motor drive.

Besides the machines, there are workbenches with vises, a bench furnace, an arbor press, layout equipment, and the like. A well-equipped tool crib is located at one end of the shop.

Shop Course. The course in machine-shop practice has been organized according to the fundamental operations of the machinist's trade. These operations are divided into four groups, arranged in order of their importance and the skill required. (See Figure 1.)

Some operations have been listed in all four groups, which means that more advanced work in the particular operation is given from time to time.

Throughout the entire course, the student receives instruction in safety, use and care of machines, tools, equipment,

Vocational School

JACKSON, MICHIGAN

Certificate of Junior Apprenticeship

GRANTED TO

In Recognition Of His Satisfactory Completion of the

Machinist's Trade Course

Fig. 2. Junior apprenticeship certificate

APCo. 9-30-300

METAL TRADES APPRENTICESHIP SYSTEM
JACKSON PUBLIC SCHOOLS
JACKSON, MICH.

Date ..... 193....

APPLICATION FOR APPRENTICESHIP

TO .....

The applicant for admission to apprenticeship and his parent or guardian state that the applicant is ..... years of age, that he is physically sound, of good moral habits, and has completed a grammar school education or its equivalent, and that the following statements are true:

Full Name of Applicant ..... Living with .....

Address ..... (Street number) (City) (State)

Date of Birth: Day ..... Month ..... Year .....

Place of Birth ..... (Street number) (City) (State)

Trade Applicant Wishes to Learn: Machinist; Tool Maker; Pattern Maker; Sheet Metal; Plumber; or .....

The applicant has attended the schools shown on the following table (begin with the last and end with first school):

Name of School	Date Commenced	Course or Subjects Studied	Date Left	Did Applicant Graduate?

The applicant has performed the following work since leaving school (fill in the following table):

Name and Address of Employer	Date Started	Kind of Work	Date Left	Wages

The applicant left his last employer for the following reasons (state reasons in full): .....

Full name of applicant's guardian ..... Relationship of guardian .....

The occupation of guardian is .....

Business address is ..... (Street number) (City) (State)

Have applicant and guardian carefully read Rules and Regulations?

If application for apprenticeship is accepted, applicant and guardian faithfully promise that applicant shall abide and be governed by such Rules and Regulations.

Witness to Applicant's Signature ..... Signed ..... Applicant

Witness to Guardian's Signature ..... (See Note) ..... Guardian

Note: Legal guardian should sign, if one appointed by Court. If none, father should sign if living and available; otherwise, mother.

Applicant must not write below this line

Appl. Investigated	REMARKS
Phys. Exam. Made	
Application Approved	

Fig. 3. Application for apprentice

METAL TRADES APPRENTICESHIP SYSTEM
JACKSON PUBLIC SCHOOLS
JACKSON, MICHIGAN

Report of ..... for week of .....

Employed by .....

Kind of work done during the week: (give approximate number of days on each kind of work)

Description of work: (make sketch and give size and material etc.)

Names of machines used:

New tools or equipment used:

Hours worked: Mon. ..... Tues. ..... Wed. ..... Thur. ..... Fri. ..... Sat. ..... Total .....

Have you any questions to ask, subjects you would like discussed, or comments on your school or shop work? If so state them here.

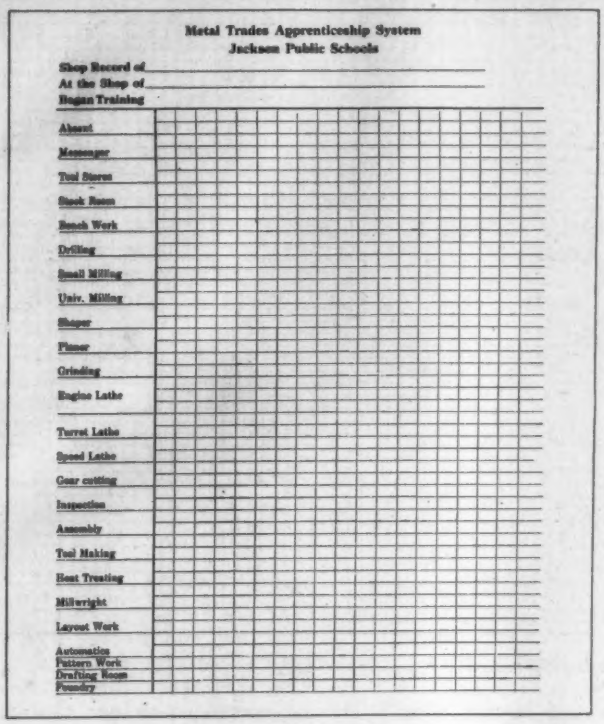
Signature of Apprentice .....

Instructor's OK .....

Fig. 4. Weekly shop report

and accuracy, which is so important in machine work. Also, vocational guidance is interwoven with the actual operations and an effort is made to develop high standards of health, social, and civic life.

Jobs or Projects. No job is given unless it is of some use to the student or to the school after it has been completed. Each boy is required to make some definite projects in all divisions, but in the majority of cases he is

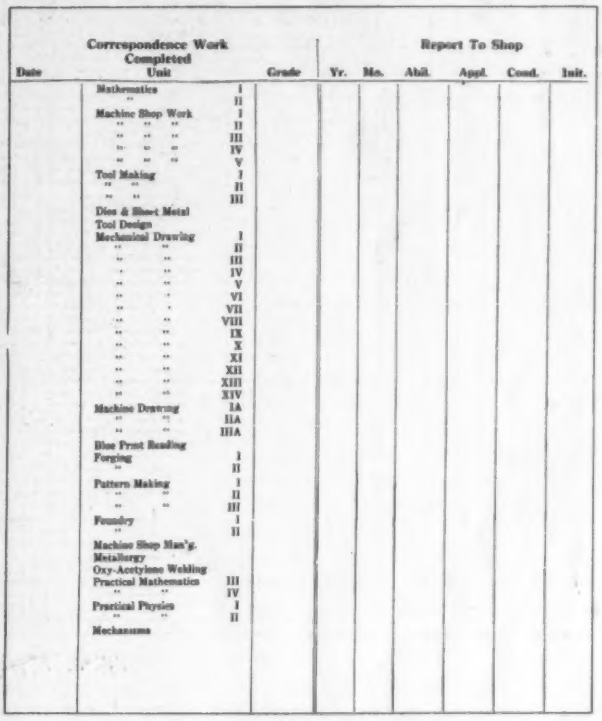


Metal Trades Apprenticeship System
Jackson Public Schools

Shop Record of _____
At the Shop of _____
Began Training _____

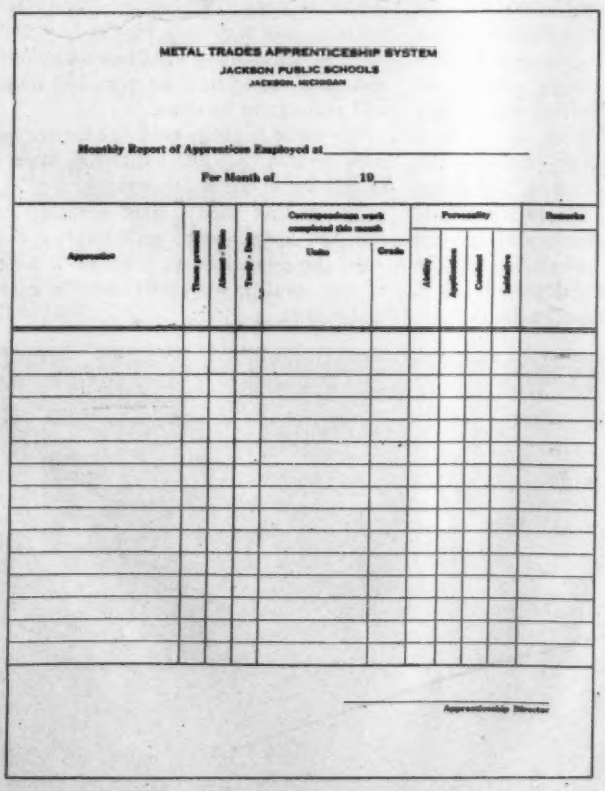
Absent
Messenger
Tool Storm
Stock Room
Bench Work
Drilling
Small Milling
Univ. Milling
Shaper
Planer
Grinding
Engine Lathe
Turret Lathe
Speed Lathe
Gear cutting
Inspection
Assembly
Tool Making
Heat Treating
Millwright
Layout Work
Automatics
Pattern Work
Drafting Room
Foundry

Fig. 5. Shop record (front)



Date	Correspondence Work Completed Unit	Grade	Report To Shop Yr.	Mo.	Abil.	Appl.	Cond.	Init.
	Mathematics	I						
	"	II						
	Machine Shop Work	I						
	" " "	II						
	" " "	III						
	" " "	IV						
	" " "	V						
	Tool Making	I						
	" "	II						
	" "	III						
	Dies & Sheet Metal Tool Design							
	Mechanical Drawing	I						
	" "	II						
	" "	III						
	" "	IV						
	" "	V						
	" "	VI						
	" "	VII						
	" "	VIII						
	" "	IX						
	" "	X						
	" "	XI						
	" "	XII						
	" "	XIII						
	" "	XIV						
	Machine Drawing	IA						
	" "	IIA						
	" "	IIIA						
	Blue Print Reading							
	Forging	I						
	"	II						
	Pattern Making	I						
	" "	II						
	" "	III						
	Foundry	I						
	"	II						
	Machine Shop Man'g. Metallurgy							
	Oxy-Acetylene Welding							
	Practical Mathematics	III						
	" "	IV						
	Practical Physics	I						
	" "	II						
	Mechanisms							

Fig. 5A. Shop record (reverse side)



METAL TRADES APPRENTICESHIP SYSTEM
JACKSON PUBLIC SCHOOLS
JACKSON, MICHIGAN

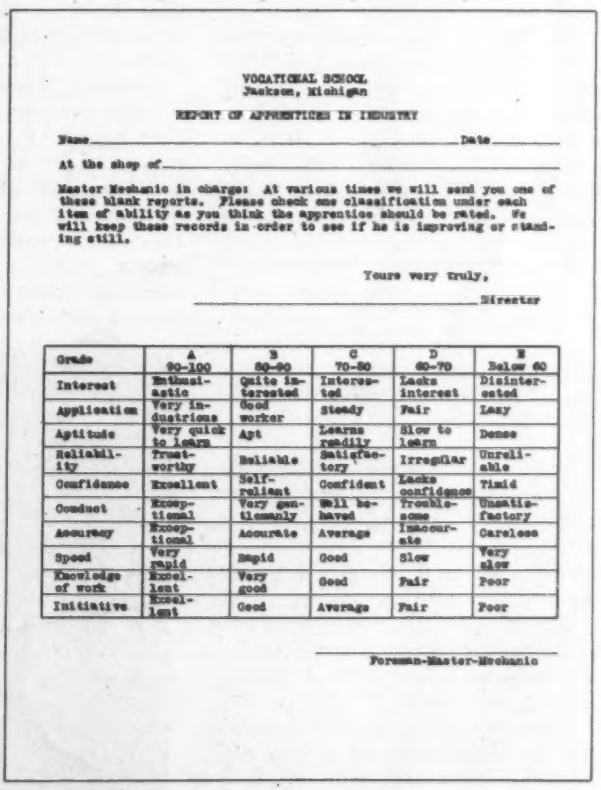
Monthly Report of Apprentices Employed at _____

For Month of _____ 19__

Apprentice	Times present	Absent - Date	Tardy - Date	Correspondence work completed this month: Units	Grade	Personality: Ability	Application	Conduct	Initiative	Remarks

_____
Apprenticeship Director

Fig. 6. Monthly report to instructor



VOCATIONAL SCHOOL
Jackson, Michigan

REPORT OF APPRENTICES IN INDUSTRY

Name _____ Date _____

At the shop of _____

Master Mechanic in charge: At various times we will send you one of these blank reports. Please check one classification under each item of ability as you think the apprentice should be rated. We will keep these records in order to see if he is improving or standing still.

Yours very truly,

_____ Director

Grade	A 90-100	B 80-90	C 70-80	D 60-70	E Below 60
Interest	Enthusiastic	Quite interested	Interested	Lacks interest	Disinterested
Application	Very industrious	Good worker	Steady	Fair	Lazy
Aptitude	Very quick to learn	Apt	Learns readily	Slow to learn	Dense
Reliability	Trustworthy	Reliable	Satisfactory	Irregular	Unreliable
Confidence	Excellent	Self-reliant	Confident	Lacks confidence	Timid
Conduct	Exceptional	Very gentlemanly	Well behaved	Troublesome	Unsatisfactory
Accuracy	Exceptional	Accurate	Average	Inaccurate	Careless
Speed	Very rapid	Rapid	Good	Slow	Very slow
Knowledge of work	Excellent	Very good	Good	Fair	Poor
Initiative	Excellent	Good	Average	Fair	Poor

_____
Foreman-Master-Mechanic

Fig. 9. Apprentice ratings

APPRENTICESHIP RECORD

DATE OF BIRTH — BIRTHPLACE — DATE { STARTED / FINISHED

COLOR OF HAIR — COLOR OF EYES

BIRTHPLACE OF PARENTS

CLASS OF WORK — GENERAL RATING

ADDRESS

DATE ISSUED — SIGNED

NOTE—PLACE FINAL RATINGS IN LAST COLUMN EACH YEAR { A=EXCELLENT C=FAIR / B=GOOD D=POOR

NAME — CLOCK NO. — CHECK NO. — REGULAR APPRENTICE — SPECIAL APPRENTICE

NAME OF INSTRUCTOR	KIND OF WORK AND STUDIES	First Year	Second Year	Third Year	Fourth Year
	Bench & Vise	1 2 3 4 5 6 7 8 9 10 11 12 6	1 2 3 4 5 6 7 8 9 10 11 12 6	1 2 3 4 5 6 7 8 9 10 11 12 6	1 2 3 4 5 6 7 8 9 10 11 12 6
	Drillpress				
	Radial Drill				
	Shaper				
	Planer to 22"				
	Planer over 22"				
	Engine Lathe				
	Turret Lathe				
	Screw Mach. Hand				
	Screw Mach. Automatic				
	Plain Miller				
	Univ. Miller				
	Hobber				
	Grinder, Cylindrical				
	Grinder, Surface				
	Grinder, Internal				
	Laying Out				
	Ft. & H. Assembly				
	Boring Mill, Vertical				
	Boring Mill, Horizontal				
	Mathematics				
	Drawing				
	Science				
	Economics				
	Civics				

Fig. 8. Apprenticeship record

allowed to select his own job, provided it includes one or more of the operations which he is to learn.

All boys are encouraged to make tools for their own home and school use. Wrought-iron work is included, which offers a wide variety.

Related Classroom Work. It is the purpose of the related studies to improve the individual's working knowledge by making him better acquainted

JACKSON VOCATIONAL SCHOOL
ATTENDANCE CARD

This certifies that

.....

attended the class for Apprentices

4 hrs. on (date).....

.....
Director

Fig. 7. Attendance report

with the technical information pertaining to the actual shop practice.

The related instruction includes blueprint reading, drafting and sketching, mathematics, shop science, pattern-making, and English.

This work gives the boys a broader understanding of life and of their work. Vocational education will fail if the boys are not prepared to meet the industrial conditions, and it was with this thought in mind that the related machine-shop work was organized. All boys spend three hours a day in related work.

Records. When a boy enters the machine shop he is given a tryout card (see Figure 1) which he keeps in a rack provided for these cards. As he completes a job or operation, he brings his card and job to the instructor. If the work is satisfactory, and he can answer a few oral questions on the particular operations completed, he is given a grade on those operations.

As the operations on one card are completed, the boy is given the next advanced card, and so on. With this method, it is very easy for the boy and the instructor to see what has been done and what should be done next, and what still remains to be done.

No grade is given until the instructor feels certain that the individual understands the operation thoroughly.

On another card is kept a record of the jobs completed by each boy.

In the related work, a record is kept of the quality of work done in each assignment.

Certificate. The certificate shown in Figure 2 is issued to each boy who can successfully pass a test on shop and related work, provided he can do nearly all the operations without assistance from the instructor.

With each certificate are issued the four operation cards showing the skill acquired in each. The operations are marked as follows: 1, indicating that he has done the operation; 2, indicating that he can do the operation well, without any help; 3, indicating that he can do the operation as well as an experienced machinist.

Most of the boys are 19 years or older when they complete the entire course.

Employment. From time to time, the names of boys ready for entrance into industry are sent out to the executives of the various shops in the city. So well has the school sold itself to industry that many of the apprentices are indentured through these employment efforts of the school.

Part II — Metal Trades

Shop Training. The plan in Jackson has been for each shop or industry to lay out its own schedule of experiences to be carried out during the apprenticeship term. The apprentice received all his shop experience in the industry where he is indentured. In most cases, the master mechanic is responsible for the shop training, and he co-operates with the apprentice director in seeing that each apprentice has a well-rounded experience.

Related Subject Matter. One-half day each week (four hours on company time) all apprentices report to the local vocational school for this related instruction. The schedule for the related shopwork is as follows:

First Year

Semester	
First	Freehand sketching
	Review of arithmetic
Second	Blueprint reading
	Formulas (use and application)

Second Year

First	Elementary mechanical drawing
	Mathematical tables and logarithms
Second	Blueprint reading and discussions on machining jobs
	Geometry, mensuration and formulas

Third Year

First	Shop economics
	Shop trigonometry
Second	Mechanical drawing and sketching
	Shop trigonometry

Fourth Year

First	Shop economics
	Machine-shop essentials
Second	Vocational English
	Mechanics, strength of materials

All the work is as practical as possible, using the *Machinery Handbook* as the main textbook, supplemented with literature, catalogs, motion pictures, and lectures by men from industries in order to acquaint the boys with different types of industrial plants.

Length of Course. The length of the training period is four years, as recommended by the National Metal Trades Association. A year is intended to mean 2,400 clock hours.

Apprenticeship Agreement. Each apprentice, after satisfactorily serving his six-months trial period in the shop is required to sign an apprentice agreement. See form.

Certificate of Apprenticeship. The National Metal Trades Association will issue a certificate, with a record of work done, to each apprentice who successfully completes the prescribed course, if the shop is a member of the association. See form. Some of the shops issue their own diplomas.

Records. A weekly report is made by each apprentice, stating the kind of work performed in the shop during the previous week. This is recorded on a permanent card on file at the Vocational School. See forms. Also, a record is kept of the amount and quality of related work done.

Reports. Every ten weeks a report is made to each shop. See form.

Forms Used:

1. Application for apprenticeship
2. National Metal Trades Association certificate
3. Weekly shop report
4. Shop record
5. Report to industry
6. Attendance report
7. Apprenticeship record
8. Apprentice ratings

Accommodating the Larger Class

Harry J. McStay

Collinwood High School, Cleveland, Ohio

The author describes and illustrates some of the changes which he made in order to make his shop accommodate a larger number of students.

Every teacher of industrial arts is looking for ways and means of improving the conditions under which he is teaching. At Collinwood High School, a careful study was made of the layout in one of the rooms with the intention of improving the existing setup in order that the teaching of industrial arts could be administered more efficiently.

Most school shops were built for smaller classes than are now being accommodated in industrial-arts work. Then, when class sizes were increased, the physical plant remained the same. To overcome these conditions, something must be done with the organization to make the work with these larger groups function properly.

My shop, for instance is 49½ ft. long and 21½ ft. wide. It contained 26 benches, 6 lathes, a grinder, a band saw, a circular saw, a planer, a disk sander, and a bench used for shellack-

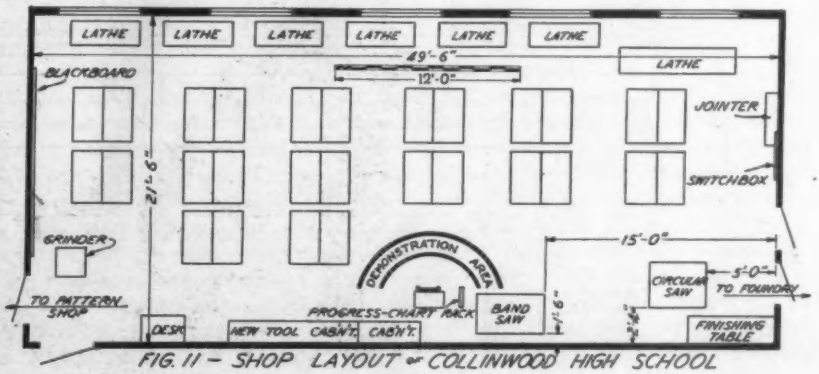


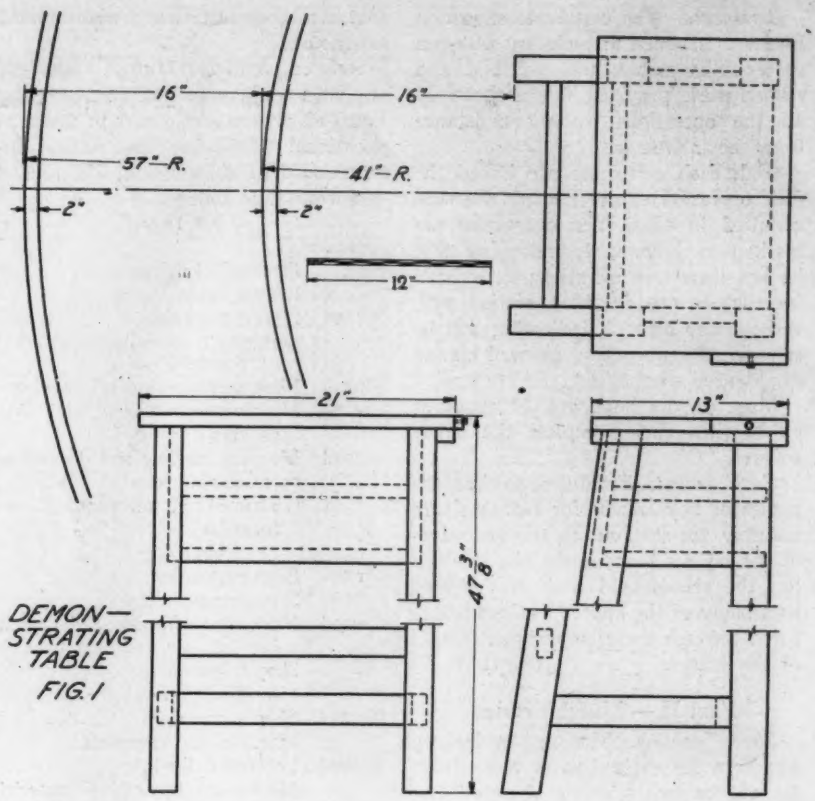
FIG. 11 — SHOP LAYOUT OF COLLINWOOD HIGH SCHOOL

ing and painting. In addition to all this, there was a toolroom which projected 6 ft. from the wall and was 10 ft. long. With a picture of this room in mind, it can readily be seen that it is quite a problem to accommodate thirty boys and give them proper instruction in such a room.

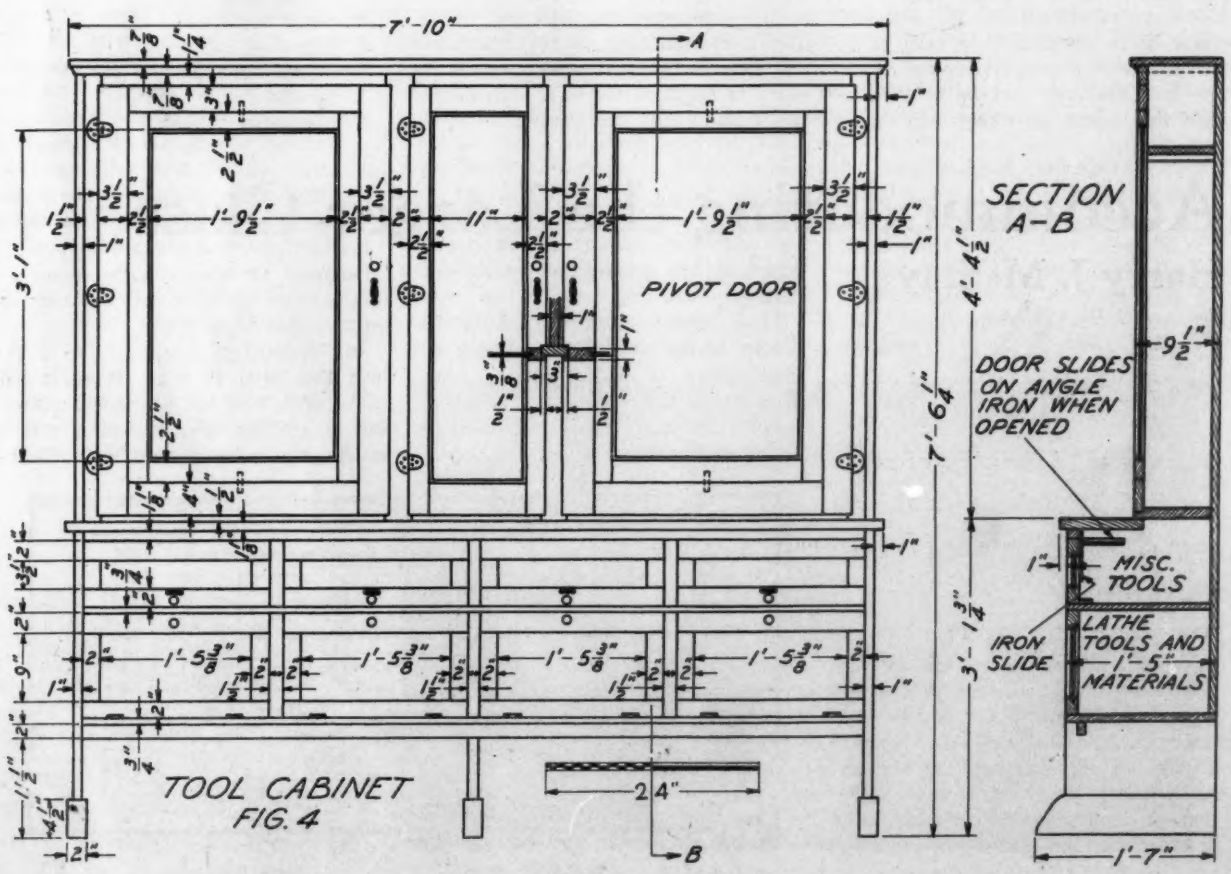
There was no space available for demonstration seats, and if the pupils were gathered around a bench with the instructor as the central figure, those in the back row had very little opportunity of seeing what the instructor was demonstrating. Conditions of this kind naturally promote lack of interest on the part of those who cannot see.

In order to make demonstrations more effective, the demonstration table shown in Figure 1 was designed. Steel plates, containing slots, were set in even with the floor, so that the demonstration table may be fastened down with bolts and wing nuts. In this way, the table can be quickly removed when necessary.

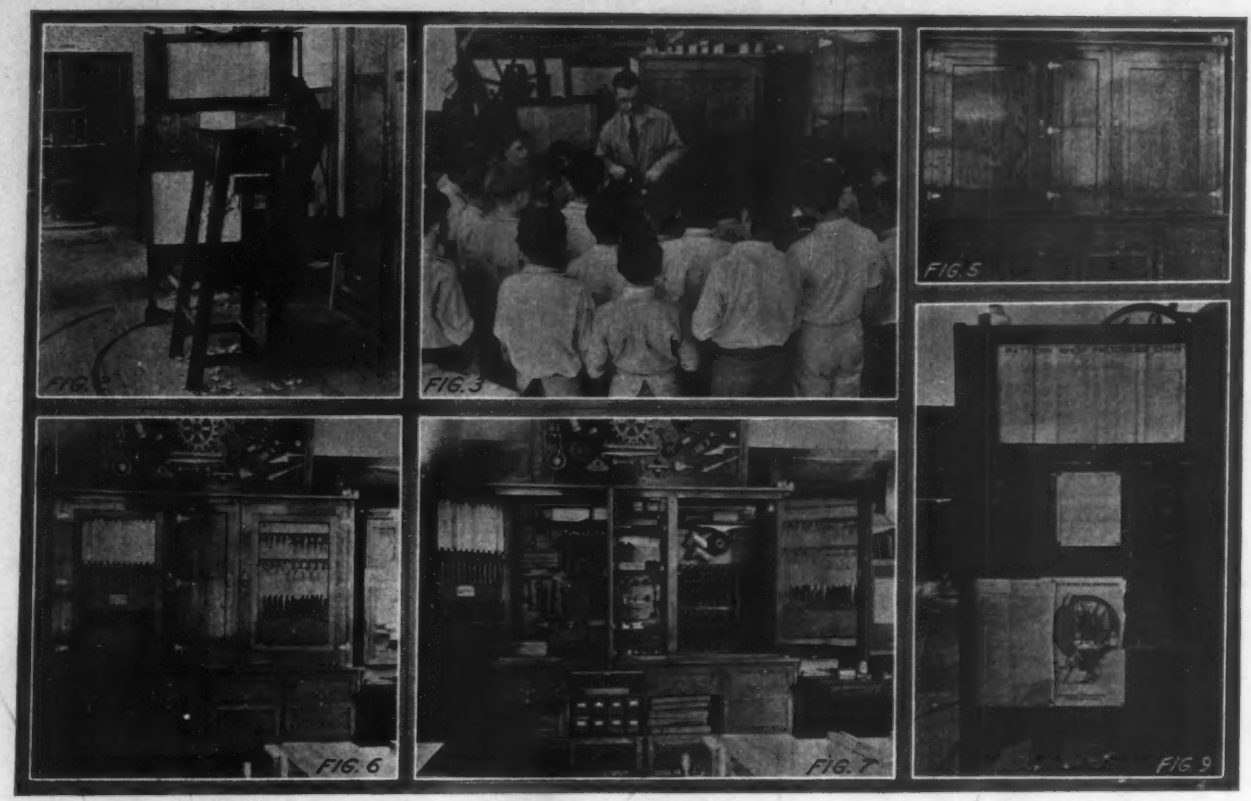
In order that every student can see the demonstration, and so that at least some semblance of order may be kept during the demonstration, two lines are painted on the floor in front of the demonstration table. These lines are

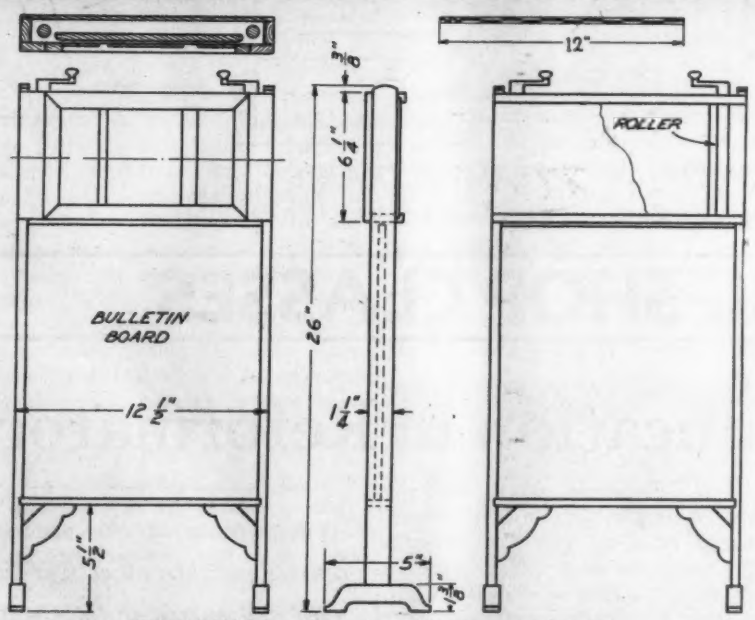


DEMONSTRATING TABLE FIG. 1



TOOL CABINET FIG. 4





PROGRESS-CHART RACK — FIG. 10

drawn far enough apart to give each pupil ample room to stand. When the demonstration is in progress, pupils are required to stand on these semi-circles, the smaller boys occupying the first circle near the demonstration table; the taller boys, the one farther back. The demonstration table is high enough to permit every boy to see. This makes it necessary for the instructor to elevate himself to the correct height by standing on a stool made especially for this purpose. Figure 2 shows the table, the stool, and the lines on the floor, and Figure 3 shows them in use.

In order to increase the floor space, it was necessary to devise some way for doing away with the large toolroom. The tool cabinet shown in Figures 4 and 5 was accordingly built. It is divided into several compartments, which have two large doors. The center panel of each door pivots. When the class is in session, the panel is turned out, as shown in Figure 6, thus placing the tools within reach of each pupil. When the class leaves, the panels are again reversed and the doors locked. A small center compartment shown in Figures 6 and 7 contains special tools and tool parts. The compartments below contain turning tools placed in boxes, faceplates, lathe centers, supplies, and one compartment contains drawers for brads, nails, and screws.

This type of tool cabinet eliminates the necessity of a student wasting his time getting his tools at a toolroom window. The tools are neatly arranged in racks as shown in Figures 6, 7, and 8 (see page 48 for Fig. 8), so as to permit an accurate check-up at the close of the class.

In addition to these changes in the shop, the use of progress charts was found to be a very great help. Figures 9 and 10 show the progress-chart rack and bulletin board, which was designed for the shop.

Much of this work was done with the assistance of Mr. R. W. LaDu, shop superintendent at Collinwood High School who deserves much credit for co-operating so whole-heartedly in making the changes.

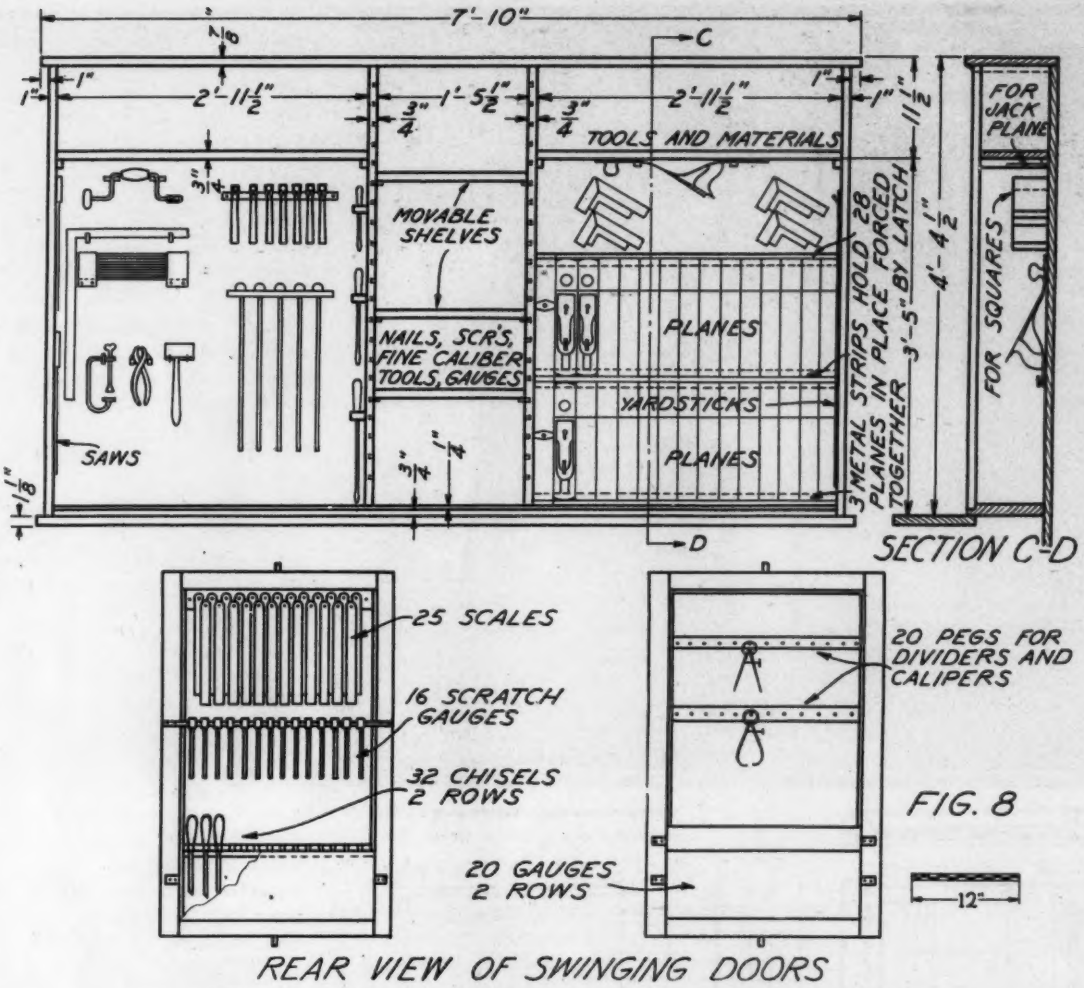


FIG. 8

Tool cabinet designed by Harry J. McStay. For description see page 47

SPECIAL SHOP CLASSES

Vocational Education in Reformatory

R. M. Kindred

Director of Vocational Education, Colorado State Industrial School, Golden, Colorado

"Where are the guards and stone walls?" This question frequently is put by visitors to the Colorado Vocational School for Boys, and seems to represent the prevailing conception the average outsider has relative to a school within a reformatory. In effect, they expect to see a veritable penitentiary and are greatly surprised at seeing just the opposite.

It is for the purpose of correcting this erroneous impression that this brief description of our vocational-education program is presented. We are sincere in the desire to give our boys a worthwhile educational program, and are especially desirous of getting away from the correctional or penal stigma that ordinarily attaches to a school of this type. We feel that this can be done best by letting people know we are running a real educational institution and not just another *reform* school.

Before attempting a description of our vocational-education setup, some prevailing practices at this, and other institutions of the same type, should be commented on. It has been the custom in the past, at these schools, to base the requirements for parole on conduct; that is, each entering boy had to earn a definite number of conduct

A description of the vocational courses and their objectives developed and offered in the Colorado State Industrial School.

Cabinetmaking and woodworking shop

credits or "merits" before he could be paroled and permitted to return to his home. It mattered not whether he learned anything, except how to comply with existing regulations and to get a "job paying the most extras."

Another custom even more pernicious, that existed here and at other schools, was that of restricting the so-called vocational activities of the school to the maintenance of the institution; that is, the vocational aspect of industrial-reform schools was, in most cases, merely a system of doing the necessary maintenance work. The education acquired by the boys under this system is being acquired incidentally. An incoming boy was assigned to the gardening department, for instance, and worked there with the end in view only of producing foodstuffs for the table. Whether he learned the principles of good gardening did not matter. He was put there to produce and not especially to broaden his own capabilities as a gardener.

Not only were the vocational-education activities of this and many other like schools limited to maintenance work, but such training as they gave was conducted without the aid of textbooks, outlined courses of study, or periodical trade journals. This fact was established in 1931, through a study made personally of the seventy industrial-reform schools of the United States and Canada. Of these seventy schools, only six used either texts, outlines, or trade journals in connection with the training given. It is true that trade-training can be given without the foregoing, but not as systematically or effectively as it can with their aid.

Eligibility for Parole

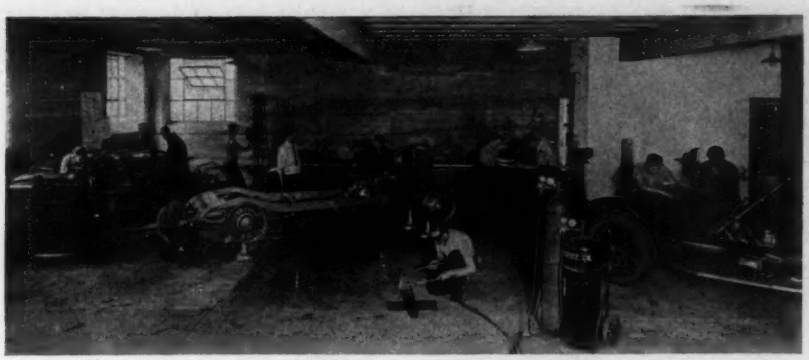
Realizing the inherent evils of the three practices, or customs, mentioned in the foregoing, we have sought to eliminate them through a carefully planned vocational-education scheme which dominates the entire organization of the institution. In the first place, the boys' paroles are based on proficiency in a trade. On entering, a boy selects a trade for which he seems to be adapted and, if his sentence is for eighteen months, which is the average, he is required to cover his course of study before he is considered eligible for parole. If he completes the course in twelve months, he then is eligible for parole provided he has averaged 120 conduct credits per month. If it takes twenty months for him to complete the required course of study, he must stay the extra two months in order to finish his work. Thus the conduct credits are made incidental to the completion of the course. The boy has only to average so many per month and not necessarily earn them down to zero as was necessary under the old system.

Briefly, the reasons for setting up such requirements for parole instead of the old "conduct," or "merit," system are two: first, it sets up something definite for the boys to do while they are here. Instead of placing a premium on the ability to "get by easiest and earn the most extra credits," a premium is placed on accomplishment. As a reward for this accomplishment, the boys are enabled to study, work, and learn something that will be of benefit to them after they leave the institution again to take their place in the community.

The reader may wonder at this time just what the above-mentioned courses of study include. Are they limited to the maintenance activities discussed previously or do they include other activities? The answer to this question is *yes* and *no*. *Yes* in the sense that certain departments, such as the culinary, are a necessary part of the daily life of the institution, and *no* in regard to sheet metal, printing, and others without which the school could exist. The courses are listed below:

Agriculture and practical farming
Automobile repairing — including oxy-acetylene welding
Barbering
Baking
Blacksmithing — including oxyacetylene welding
Bricklaying and stone setting
Cabinetmaking
Carpentry
Cooking
Dairying, creamery operation, stock and poultry raising
Drafting — architectural and mechanical
Electricity and house wiring
Engineering — boiler-house operation
Fiber furniture weaving
Gardening, canning, and fruit raising
Laundering and dry cleaning
Linotype operation
Machine shop
Motion-picture-machine operation — sound-on-film

Furniture and rug weaving



Automotive shop

Office practice and commercial subjects
Painting and decorating
Plastering and cement work
Plumbing
Printing
Sheet Metal — including oxyacetylene welding
Shoe repairing and making
Tailoring

Industrial Materials

Equipment necessary for the teaching of the trades enumerated is complete, and in most cases entirely new. The equipment includes also a complete list of text and reference books and trade journals for each trade.

One item of equipment is the 16-mm. projector which is used to show films related to each trade. Regular film service is maintained with the University of Colorado and the films are shown insofar as possible, when the course requires it. The main reason for employing motion pictures is the wide range in individual differences mentioned later in this article. Not only are the departments well equipped but the new machines and appliances were procured out of savings and not through extra appropriations. It is not the purpose of this article to discuss equipment, however, so that phase of the vocational setup is discussed only briefly.

Academic Education Subordinated to the Vocational

Believing that we can do more good for our boys by giving them vocational rather than academic, or liberal education, we have taken the view that the traditional academic studies should be vocational in nature. For that reason we are endeavoring to include in the subject matter the things our boys will be most likely to use in life situations. If a boy is in the high-school grades and still needs spelling, penmanship, or special problems in arithmetic, those things are exactly what he will get. In other words, we are trying to give in the academic-school section only what the boy needs in his particular vocation.

Upon entrance, each boy is placed in the trade or vocation course he wishes to take up. Placement is made upon an exploratory basis and not upon the results of aptitude tests. The latter have been tried, but we find it more satisfactory to give each boy an actual try-out in the work that he wants to do and is interested in. If he is unsuited to the first selection, he is transferred until a place is found where he is better adapted.

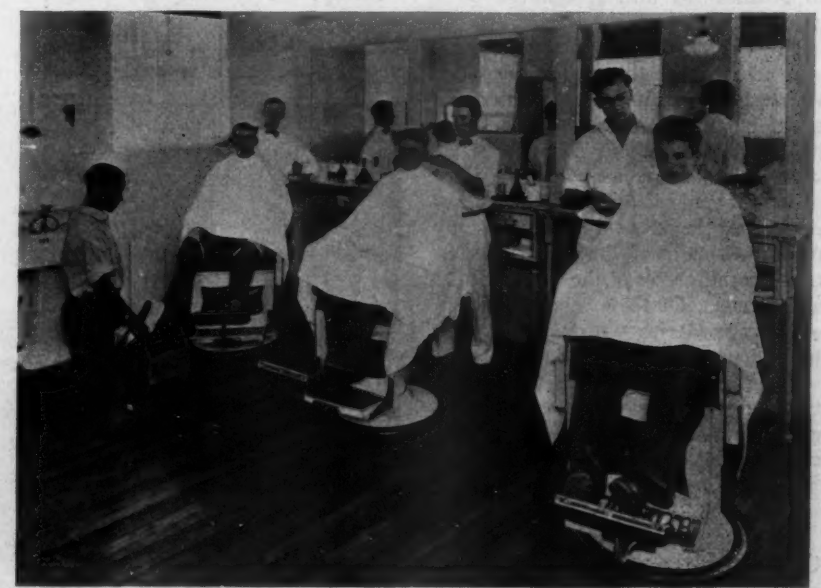
After the boy is enrolled in a course of study, he is given his individual course outline and begins his actual work. If he is in the academic-school section (1st to 12th grades) he attends school one day and works in the department the next, thus alternating between school and trade. On his day in the trade department, he has one hour of study of theoretical or informational topics and about six hours of practical work. Each instructor conducts classes regularly for an hour each day, and, through the individual course outline, has very definite essentials of knowledge and skills to impart to the boys.

The individual course outlines mentioned, really are nothing more than workbooks, devised to fit our own particular needs, although they are general enough for the purpose of aiding in teaching a trade to apprentices in any type of school. They serve several purposes, the most important being:

1. To set up a definite outline for the instructor to follow, thus insuring that he gives the boy the information and skills necessary to becoming a skilled tradesman.

2. To tie the informational and practice jobs as closely together as possible. Each unit of the course consists of a reading assignment, shop or practice assignment, and a number of questions or problems on the unit with the necessary spaces for writing in answers or notes. Thus the student reads how to do a given job, goes to the shop and develops skill in doing it, and writes the answers to the related questions or any notes he cares to jot down.

3. To make allowances for individual differences by letting each boy work at his own rate of speed. It is common to have boys in all the departments, who range in chronological age from 10 to 22 years of age and these same boys may range from the elementary grades to the high-school grades. Obviously, these boys will have varying rates of



Barber shop

progress and the instruction must be individual. Again, we have a "floating" population. There are boys entering and leaving almost every day. To keep such a group together would be impossible, so an individual workbook or outline of the course of study is an absolute necessity.

4. To serve as a checking device on the progress of the student through the course of study. When a boy enrolls in a given course, he can see just what he has to accomplish in the way of reading and practical work before he can be paroled and return home and can check his progress through them.

5. To aid in teaching moral responsibility by making each boy responsible for the successful completion of his own, individual course of study.

In connection with the points just enumerated, it is advisable to digress and discuss the reasons why boys are sent to a reformatory. The following table lists the offenses of the present group as given on the individual commitment papers.

TABLE I

Offenses Committed by the 253 Boys at Colorado Vocational School

Offenses	*No. of Boys*
Stealing	69
Stealing car	41
Breaking into store	26
Running away from home*	25
Incorrigible	20
Stealing bicycle	19
Truancy	15
Prohibition violations	13
Violation of parole	10
Rape	5
Shoplifting	3
Incompatibility (with stepparent)	2
Tampering with U. S. mail	2
Manslaughter	1
Counterfeiting	1
Perjury	1

Since, from a vocational and personal standpoint, we are interested in the causes of a boy's delinquency rather than the offense itself, we must go into the background of each case, and see whether there are certain factors that have contributed to the cause. In other words, why did so many boys steal, and so many run away from home, violate the prohibition laws, etc.?

We cannot answer these questions definitely, but we do know from experience that the economic and social status of the family has a very distinct influence on the boys' delinquencies. One phase of the family status that seems especially pertinent is, what I have called for lack of a better name, the *parental situation*, data on which is listed in Table II.

TABLE II

Parental Situation of Boys at Colorado Vocational School

Both parents living together	98
Father dead	61
Parents separated	52
Boy has stepfather	42
Mother dead	30
Boy has stepmother	24
Both parents dead	12
Total	253

*Practically all these cases are boys who were inmates of the State Home for Dependent Children.

The swimming tank

Please notice that 155, or 61 per cent, of the boys come from homes in which the parents either are separated or the father, mother, or both, are dead. The result seems to be that the boy, in the majority of cases, does not have adequate supervision at home, has little if any personal responsibilities, and becomes morally irresponsible at about the time in life when he should be acquiring, or increasing, just the opposite trait. For that reason we are shifting the burden of earning his way out of the school onto the boy himself. The required courses of study are a very definite aid to the business of making each boy responsible for doing the things necessary to becoming eligible for *parole*. We feel that he will derive considerable lasting benefit from having been required to complete the tasks set up in his outline and have faith enough in them as a learning device that we are organizing such outlines or courses for each of the 27 trades previously listed.

Social Welfare of the Boys

Another phase of our developmental scheme is the social life of the boys while in the school. On entrance, the boys are assigned to one of five *companies*. Each company has its own cottage, which contains a dormitory, recreation room, wash and shower rooms. A company supervisor has charge of all companies and looks after the sanitation, clothing, and evening recreational facilities for the entire school. The larger companies each have a pool table and other games, and the boys above 16 are furnished pipe and tobacco twice daily, the smoking required to be done in company quarters. Other recreation is provided in the form of intramural games of volleyball, baseball, basketball, football, and track under the supervision of a qualified playground director and coach, games with outside high-school teams, and swimming one night each week in the gymnasium pool. Sound-motion pictures are given in the little theater on Wednesday and Saturday nights and other entertainments are given occasionally. A monthly birthday party is held for the boys having birthdays in

that month, and a big Christmas party is held each year.

Spiritually, the boys are required to attend general church services each Sunday morning and denominational services, such as Catholic, Christian Science, Jewish, etc., are held at other hours through the day. A chaplain is a regular member of the personnel, also serving as one of the academic teachers, and he, together with a staff of near-by ministers, alternates the duty of conducting general church services on Sundays.

Military training is given by a former army officer, the objective of the training being the teaching of discipline and the correction of bad posture through establishing a soldierly bearing. We do not attempt to make soldiers out of the boys, but give the training for the reasons given, and to facilitate handling large groups.

As regards the daily life of the boys, they are up at 6:00 a.m., make their beds, clean the quarters, have drill, eat breakfast, and go to work or school at 7:45. At 11:30 they return to company quarters, wash up, and have lunch at 12:00. At 1:50 p.m. they again go to school or work, are recalled at 4:30, have supper at 5:00, recreation period from 5:30 to 8:00 and are in bed by 8:30. Each company has a day and night commander who is assisted by boy officers in maintaining efficiency and order among the boys. A school matron inspects the quarters daily and makes recommendations for improvements needed.

Now, to answer the original question, where are the guards and stone walls? There are none. In years past, guards were maintained to keep the boys from running away, and they still had runaways — plenty of them. In fact, it was not uncommon to have ten or a dozen runaways each week.

With the coming of the present superintendent, the guards were done away with and the runaways have practically disappeared. There is very little to restrain the boys from going A.W.O.L. There are no stone walls or high fences surrounding the grounds. The boys work in groups or singly away off in the fields by themselves. They come and go from one department or building to another without supervision and very few of them ever run away.

The underlying philosophy that was responsible for this change is simply a recognition of the fact that because Johnny Jones stole a car or committed some other dishonest act, is no indication that he will violate the confidence reposed in him by running away the first time someone's back is turned. We feel, and perhaps, justly so, that our boys are no different than the general run of boys in the public schools. In fact, some of the boys at this school "got caught" for what they did, while many of those on the "outside" did not get caught. And not all our boys are here for misdemeanors as is shown by Tables I and II. In many instances boys are here simply because they "have no home," or "couldn't get along with a stepmother (or stepfather)." Several boys were deserted outright by their parents.

Special Privileges

In addition to removing the guards, the boys are given still further opportunity to prove their reliability. After six months' clear record, a boy is allowed to go home, alone, on a visit or he can go to Denver, Lookout Mountain, to Buffalo Bill's grave — a favorite "privilege" with the boys — or on a hike in the mountains which are right in and at our back yard. The encouraging thing about these "privileges" is that out of several thousand such visits or trips only about three boys have violated their trust by failing to return at the specified time. While many of our boys are below average in intelligence — the median I.Q. is 87.5 — and many are below average physically, here, again, the background of each case must be considered. The surprising thing is that the boys do so well, considering their heritage, past environment, economic status, and other things. From the way they respond to kindness and opportunity it seems self-evident to us that many of them never had a chance in life. A specific case is a 19-year-old boy who could not read or write when he came to us. He had never had an opportunity to go to school but here he made the first three grades in one year. Several others have done almost as well starting from "scratch," as he did, which indicates that the boys, in many cases, are illiterate and probably have below-normal intelligence simply because they have had no chance in their earlier years to broaden their native powers.

An Abundance of Practical Work

As to the practical phases of the boys' trade training, since every building on the campus has been, or is being, remodeled, ample practical experience is at hand for the boys of the building and allied trades. A few of the jobs were the remodeling of the chapel into a theater, the gymnasium addition and swimming pool, hospital, company quarters, and a new project in a library and home for the superintendent to be completed as fast as finances will permit.

The boys' clothing, including socks and shoes, is made on the grounds by the tailoring and shoemaking departments, laundry service, of course, being provided by the laundering and dry-cleaning departments. Much of the foodstuffs consumed are produced and canned by the gardening and farming crews, and dairy products are made possible through the maintenance of over 100 head of purebred Holsteins, some of which rate as champions in their respective classes. In printing, the boys turn out all the school forms, a weekly newspaper, and work for other state institutions.

This cursory description of the practical work only gives an idea of the possibilities for practical experience that the various trades have at their disposal. We know beyond all reasonable doubt that our boys will receive more training and skill here in six months than they would in any twelve months when starting to learn a trade as an apprentice on the "outside." The ordinary apprentice starts in as a "grease monkey," "printers' devil," or what not, and under this arrangement spends his first six months almost entirely in doing the dirty work of the shop, whereas in the same period our boys will have had an opportunity to acquire approximately one third the essential skills of their respective trades, and will have read and studied much of the informational or theoretical.

We say this advisedly knowing that some boys will not make the progress others will; however, the setup is there for a boy to roll up his sleeves, go to work, and progress to the best of his ability. He has added incentive to learn in the fact that if he acquires skill and covers his course of study in less time than the average allotted time, he can be paroled and return home. Still further incentive to work and learn is provided by intelligent, sympathetic instructors who are ready to help the boy. The volume of practical work is sufficient to insure that the school will never have to resort to "practice exercises" solely as a means of developing skill in the various trades.

Shopwork for the Special Class

Kenneth R. LaVoy

Frazer School, Syracuse, New York

The school shop for the retarded is a logical, if troublesome, answer to a problem found in every type of community.

Teaching handwork to exceptional children, especially those unfortunate ones whose intelligence falls below the normal, is one of the hardest, and yet one of the most interesting fields of work that a teacher of industrial arts can be called upon to enter.

It is not our purpose here to consider the ungraded, or so-called "retarded" classes, but to concern ourselves with those classes or schools where the pupils are definitely graded by a competent, trained psychologist. The pupils in this group will have an intelligence quotient ranging between 50 and 75, and in chronological age may be anywhere from 10 to 17, the latter age depending of course upon the school attendance laws of the locality.

A picture of the type of child under discussion is presented quite clearly by the following statement taken from the report of the White House Conference on Child Care:

> Children who eventually learn to perform relatively simple, unskilled tasks with occasional oversight and who are often capable of earning a living under favorable conditions or supervision, but who are incapable of progressing industrially beyond the common labor or apprenticeship level in simple vocations, children who often succeed in acquiring some advantageous social habits but who are usually incapable of successful unassisted adjustment to changing social or industrial conditions because they lack what is popularly termed good judgment, common sense, and planning capacity, or because they fail to display sufficient resourcefulness, reasoning, initiative, energy and insight to meet social requirements in their particular communities.

Fundamentally, the handwork for this type of pupil is the motivating interest of his school life. Practically all psychologists and others who have worked with the feeble-minded are in agreement as to the value of shopwork in the training of these children. This is not surprising, because their only hope for occupational satisfaction depends upon their learning rudimentary skills and proper attitudes toward work. Furthermore, it is a normal desire of boys of this age group to make things — and these boys are at least normal in this respect. They are limited through their deficiency of mental endowment to jobs of a respective nature, and, at the most, to those of a semiskilled classification. Too often, however, the handwork taught has been merely woodwork supplemented by basketry, rug weaving, or some kindred institution-like type of work. The supposition seems frequently to have been that because a boy of 12 might have the mental age of a child of 8, he would enjoy doing the same kind of work that a child of 8 might be interested in doing. While this might be true of an occasional child, it is a grossly mistaken idea for a group. The work must, of course, be graded to their abilities, but it also must appeal to them as worth doing. The fostering and developing of desirable habit patterns toward work can only be brought about if the boys have an interest in and a respect for the type of work they are required to do. Forcing them to do work which does not fill these requirements only results in antagonism toward the school and, to some extent, toward work, as such.

The size and type of community from which the boys come will naturally influence the choice of work to be taught. The larger communities may have, and should have, a school solely for these boys. If so, the choice of shopwork can be quite extensive. In one such school, for instance, we find woodworking, metal working, shoe repairing (with machinery), electrical work, drawing, broom making, mat making, together with printing for the boys of higher I.Q.'s. In smaller communities the boys need not necessarily be limited to woodworking or basketry, however, as the single shop, conducted on the diversified plan, is adaptable to their needs. A portion of some school may be set aside for their use. The unit should be, if possible, large enough so that the shop teacher will devote all his time to this type of teaching.

In setting up a general shop for boys of the atypical group, elaborate equipment is not necessary, nor is it even desirable. Various types of activity can be provided for without making the set-up too expensive. Woodwork in its different branches is always a dependable foundation course. It is a medium through which boys can always be interested. It should not be a straight manual-training course, however. Wood carving, whittling, furniture refinishing, all contribute variety, add to the interest and are worth while from the teaching standpoint. Shoe repairing requires no expensive equipment to be adequate. A half dozen lapbases, assorted lasts, and a few hand tools enable the boys to do satisfactory heeling and half-soling. Moreover, it appeals to them as being "man-sized" work. Elementary electricity, including simple wiring, and covering such projects as magnets, buzzers, and motors offers a fertile field, as does sheet-metal work from patterns, and bent-iron work.

An unusual but practical job for one or more boys can be provided by the purchase of a used barber chair, clippers, shears, hair cloth, and comb. Most of the boys will readily consent to have their hair cut in the school shop, and it is not difficult to train one or two class barbers each term. A shoe-shining stand is also a feasible addition to the shop equipment. It encourages the boys to take pride in their personal appearance. In fact, there is really small excuse for confining the shop opportunities to a narrow program. Inasmuch as many of the boys will spend three or four years in the same school and shop, it is vital to have a broad range of activities. Aside from the interest factor, which cannot be stressed too strongly, a diversified program offers splendid opportunity for vocational guidance and exploration of aptitudes.

For this type of work many of the usual teaching devices will not function. Lectures, for example, are of little or no value; and lesson plans and job sheets are useless. Many of these boys have difficulty reading the simplest exercises, and those who do read better cannot, in most cases, translate printed instructions into action. Pictures or drawings that are largely self-explanatory are a big help. The demonstration is the thing, but the teacher will have to demonstrate the

operations and procedures over and over again before all the pupils have any clear idea as to the results wanted. Short jobs, not too difficult, and jobs in which progress is easily seen, are the most desirable. Unstinted praise of each little advance made is a big factor in securing progress. In spite of an inability to follow verbal instruction and to maintain interest in any complicated project, many of the boys develop considerable skill in tool operations. This ability, when utilized, enables a few of them to become self-supporting members of the industrial world after leaving school.

No effort should be expended in endeavoring to have a class maintain an equal pace, for these boys vary in ability as widely as do normal boys. The main thing is to assign the work so that each boy has a job within his range of accomplishment.

Dr. Leroy Maeder sums up the objectives of the special classwork as follows:

> Here the child will receive academic instruction and social training to the limit of his capacities, including emotional control, good habits, moral discipline, inculcation and bolstering of desirable traits and modification of the undesirable. The social, moral, and emotional training is just as important as the scholastic.

A shop of the type we are discussing naturally will keep the instructor on the jump, so to speak, if he is to hope to accomplish these ends. Dominic must be watched to see that he does not nick an ear or get a chopped effect to the haircut; James must be shown how to cut the leather with a minimum of waste, as well as how to nail the sole so that the nails are properly clinched and not left to tear stockings or blister feet; Tony must be cautioned that shoe polish costs money and shown that a small amount properly applied gives a better polish; Henry needs help with his soldering job; Frank has trouble bending the iron to pattern; John, who has consistently refused to recognize that bells last longer when a screw driver is used in place of a hammer for driving screws, must be reminded of it again; while Steve must again have put before him the idea that a foreman is supposed to be helpful rather than merely talkative. Such a shop is indeed a busy place.

Education for the Subnormal Boy

Paul L. Caulwell

Bradford Public Schools,
Bradford, Pennsylvania

The boy with the low I.Q. is ever-present in the school and he must be taken care of in some way or another. The author shows how he is trying to do it in his shop.

This article describes an attempt to interest subnormal students in regular schoolwork, by using a comprehensive general shop as the "interest-finding" factor.

Most of the success achieved thus far has been due to the fact that the superintendent, James F. Butterworth, has granted the teacher of the general shop a large amount of freedom in handling and dealing with each particular boy. Contacting the homes of the pupils also has aided in making the work effective.

Since health is such an important factor, the unusual co-operation of the school nurse and dental hygienist must also be credited with part of the success which has been achieved.

In each case, consent of parent or guardian is obtained before placing a student in this special class. If disagreement arises between the pupil and teacher, the parent or guardian is at once contacted and their aid in helping to solve the difficulty sought. The fact that most parents have thus far given the school their wholehearted co-operation and support, has assisted greatly in furthering this attempt.

The entire experiment may be considered as a means of trying to help the boy in each particular situation, dealing with him as an individual rather than one of a group.

These boys, nineteen in number, are in the shop five days a week. The shop teacher is answerable for all of the education, guidance, and supervision which these boys receive at school. It is his job to teach them the fundamental subjects together with the shopwork, making all instruction as practical as possible.

The great majority of these boys previously were discipline problems and misfits throughout the school system. Nearly all are underprivileged. Their mental age in most cases is from two to five years below their chronological age, which is from 11 to 16 years.

One of the greatest problems confronting any teacher in this type of work, is winning the individual's confidence and respect. Naturally, then, the first thing to do is to learn to understand and know each pupil as an individual, trying to show him that the teacher is interested in everything the student does, not only in school, but during the leisure hours as well.

The comprehensive general-shop course laid out for these pupils includes woodwork, general metal work, electrical work, and elementary mechanical drawing.

Before proceeding with a job, the boy is first required to make a simple accurate drawing of it. Then he must show that he understands, in a general way, how to proceed with the work.

Related information as to the tools, materials, and vocations is combined with the shopwork. Part of this information is conveyed by the lecture method, part by closely directed and supervised reference work done by the boys themselves. In this manner, they contact not only books but men from nearly all walks of life to obtain the information they desire.

Throughout the course, the teacher must strive to raise the boy's personal attitude toward work. He also must develop confidence, and the ideals of obedience, orderliness, cleanliness, and the like, in these pupils. Besides this, they must be taught to be honest, reliable, thorough, and to do independent work, each on a level of his own. They must also be instructed how to sell their time and labor as advantageausly as possible.

Thrift is taught by showing them the value of materials, and how to avoid the waste of time, energies, health, and money. Right attitudes toward parents, neighbors, school, and the law must be inculcated in them, and they must be led to develop good habits of social living, of unselfishness, of reliability, of honesty, and of truthfulness.

Through the co-operation of the local agencies, such as the Y.M.C.A. and others, the use of gymnasiums and

swimming pools may be obtained which usually results in the boys showing an added interest in athletics.

In our school, half a day is devoted every two weeks to visits to industrial establishments. Upon the return to the shop the results of the excursion are discussed. Teachers and students co-operate in planning and arranging questions, so that the boys have some idea of what to look for on these shop visits.

In our general shop, some boys work on projects in metal while others are engaged on projects in wood, or in electricity. At the same time, there are others engaged in writing, studying, drawing, etc.

Practically all the projects in wood and metal have been planned so that they are useful in the home. This as experience has shown, creates a closer relationship between the school, the boy, and his parents or guardian. At the same time, this school-shop experience prepares him to do small repair jobs around the home.

The pupil is led to observe the object from the viewpoint of design and construction, guiding him in his judgments. Elementary mechanical drawing is taught very inexpensively by using rulers and typing paper. In this manner the students receive the fundamental principles of mechanical drawing, and this also helps them to interpret small working drawings of projects on which they are working.

Each boy is required to keep a notebook, and this is checked frequently. In this way, the teacher can discover many ways in which he can help and guide the individual.

Current problems that may be of interest and value are introduced whenever possible. In mathematics, the class is divided into groups. Some pupils are helped in elementary arithmetic, while others can do related problems dealing with their work. In the related work, science, health, social living, environment, home construction are introduced and this is done in each shop activity. Pencil sketches, and the boy's ideas, criticisms, and remarks are always welcomed.

One of the greatest things an instructor can do for this type of individual, is to teach him to help himself by putting forth his efforts and using what ability he has. Most of these boys are destined to spend the greater part of their lives at the lower levels of economic life. They are not interested in possible future values but must be shown the immediate present value of any particular job and they are not interested in theory or abstract problems. They must be led to develop independence and freedom (through guidance), so that they can develop and broaden out their views and ideas.

The teacher must get down to the level of the individual and gradually work up, at the same time trying to find things that will interest him, thus arousing him to use his own initiative.

Co-operation is an essential factor that can be developed. In our shop, for instance, the boys made knitting needles, knitting-bag tops, cookie cutters, etc., for a special class of girls in the school system. This attempts to show the boys the value of their work and develops the idea of assisting others. A few of the jobs are worked out on a production basis. Thus the boys constructed and made ninety toys for needy children at Christmas last year. On this job the production method was employed. Each day is started with setting-up exercises in the shop. The pupils have a place to keep toothbrushes, and each individual is taught and urged to keep himself clean at all times. The main objectives of this class are to change negative into positive personalities, to develop character, and to produce good citizens which, after all, should be the ultimate outcome of all education.

SHOP MANAGEMENT

Controlling Theft in the School Shop

E. L. Southard
High School, Sapulpa, Oklahoma

V. J. Lockett
Principal, High School, Fairfax, Oklahoma

M. M. Black
Sand Springs, Oklahoma

A good plan that deserves careful study and a fair trial. The three authors collaborated on this material during a summer session at the Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma.

One of the most disturbing elements in a smooth-running shop schedule, and one prone to give gray hair to conscientious shop teachers, is the matter of theft in the school shop. It is an insidious, pernicious, and demoralizing influence and one difficult to put one's hand on. The teacher, however, is all too aware of its existence. This problem has always been present in school shops but has been accentuated during the past three years because of the "depression." This is perhaps due in large measure to primal instinct to supply individual needs. No jobs being available to command the means of supplying these needs the covert seizure of property is resorted to by many, and this type of crime has been greatly increased as a result. Added to this instinctive and obvious reaction to the present economic severity, there is the further one of a dangerous social attitude that has grown up during this period in the minds of so many jobless and indigent who become firmly convinced that the government or society owes them the fulfillment of their desires simply for the asking. This attitude, of course, has been established and fostered by the emergency measures necessary to prevent actual human starvation and extreme privation, and we have a

great increase in crimes of theft in and out of school in consequence. Many a boy, following the dictates of his environment, takes school property with no qualm of conscience whatever. This decided increase in the worrisome practice of theft in the school shop is widely testified to by shop teachers the country over. These teachers are concerned about controlling this loss of physical equipment which has become still more serious now in the face of decreased budgets and of the strenuous efforts made to economize in school expenditures. It is further obvious to the thoughtful observer that theft in the school is doing great social and civic harm to our coming generations, and society at best must carry for years to come this blighting let-down of civic morality and uprightness. If theft as a practice is not dealt with we are doomed to have great numbers of individual members of our nation who will have a life philosophy and civic understanding that is perverted, warped, and wholly unsound for a democratic, self-governing society. The shop teacher shares the responsibility with the academic teacher to keep up the ideals of our schools. To comprehensively cope with this menace, the shop teacher has two lines of attack that he should use; subjective theft control, and objective theft control.

I. Subjective Theft Control

By subjective theft control is meant the building up in the youngsters themselves, a staunch adherence to right principles and a strong will power such that they will inhibit their own untoward impulses to steal. This is, so to speak, checking the evil at its source and is the remedy every teacher should attempt to apply first of all to theft practices.

The teacher can attempt to build up this moral tone in the boys by devious ways and more or less intangible methods. He must have a certain state of mind himself and have had certain pertinent experiences and appropriate training for his job as a leader of boys. He must know and apply a practical psychology. He must have a very broad sympathy for humanity and a patient understanding of human nature. He must be altruistic, charitable, kind, firm, just, unprejudiced, and stern all at the same time in attempting to build up moral stamina in his boys. The keystone of the whole endeavor to control thefts subjectively lies in mutual confidence between the shop teacher and the boys in his classes. The boys must admire and respect their teacher, and the teacher in turn must show a friendly, helpful, and sympathetic interest in all boys. A truism is, "If you want friends you must show yourself to be friendly," and it defines almost the sum and substance of achieving mutual confidence between teacher and student. Then in addition to a creation of mutual confidence and respect and as an outgrowth of it, the teacher can build up in the class or group an active, vital, participating exercise of citizenship within the shop wherein the boy attains a group consciousness. He comes to feel one with the group and to sense that it is his part to maintain the good name of the class, to uphold the class pride, and to experience the inward satisfaction that comes from loyalty and honesty toward his fellows. There are very few boys who do not have these basic human traits within them and it remains for the teacher to work out methods of procedure that will foster and mold these raw materials into good characters.

The only functioning way to build up citizenship consciousness and good citizenship practices is to expect or demand participation in the activities and responsibilities of the class on the part of every boy. This group co-operation must be voluntary and not under constraint or pressure from the teacher. If it is necessary to insist on certain things, the teacher can do it in such a subtle way as to make the student feel that it is his own free will and thus avoid the practice of coercion which is an antithesis to the building up of democratic ideals and practices in the group. These participating experiences on the part of the members of the shop class would definitely be such things as checking tools, taking care that all supplies are accurately accounted for, and meting out justice to an offender of the class code of ethics. The skillful and alert teacher can devise numerous jobs around the shop calling forth student participation and responsibilities in those matters that concern the good of the class as a whole. Having the boys undertake the definite responsibilities relating to the routine of a shop, is a challenge to those inherent traits mentioned as present in a normal boy by nature, and will so quicken his pride and group loyalty that he cannot shirk. To the occasionally recalcitrant individual there comes the severe condemnation of his fellows, the most potent of all stimulants to acceptable behavior, and he is brought back in line to discharge his share of the class responsibilities. The teacher must expect to build up character and good citizenship within his boys to bring about subjective control of thefts in the shop and such can only be done through activities or experiences of the boys themselves, skillfully selected to obtain that end. It cannot be done by preachment.

II. Objective Theft Control

Though we strive to build up within the boys themselves correct attitudes and habits we will not by any manner or means attain one hundred per cent in results. Such would not be altogether natural in this mundane world and it behooves us to "lock the barn door before the horse is stolen" by being practical minded enough to put temptation out of the way of weak individuals as much as possible and to make secure our shop equipment that it cannot be carried away. We will suggest some definite measures in control of shop theft in an objective way that have been used, or are being used, or that might be used in the school shop.

The Shop Room. The shop room itself should be arranged so that it can be locked securely. There is ever present the danger of some marauder breaking into the shop from the outside. The windows of the shop should be securely locked so that a light job of "jimmying" or the matter of breaking the glass will not suffice to permit entrance. Windows near the ground can best be covered with strong metal screens or guards securely fastened to the window frame. Keys for the shop should be possessed by the teacher only, or if necessary, the janitor may carry one. At least one storage room within the shop should be available to which only the shop instructor has access and which has strong locks. Into this room at the beginning of the vacation period may be moved the equipment that is easily taken away and thus stored for the period when the shop is unused and unattended for a considerable time. This room might be the lumber or finishing room for the use of the classes during the school year. Shops should have as few entrance doors as possible, preferably only one. In many cases the janitor himself is none too reliable and he should be made to check in the shop keys to the shop instructor or to the principal of the school at the close of the school year. Where the janitor is a problem in this connection, the use of the private storage room as suggested will practically solve the problem as far as this individual is concerned. Especially in the case of change of shop instructors over the vacation period is the dishonest janitor likely to play havoc with shop equipment.

Tool Marking. In keeping up with shop tools, the matter of marking them is of vital importance. Some characteristic marking, hard to erase and easily recognized, should be put on all tools and equipment likely to be carried off by a thief, whether by boys during class periods or outsiders at other times. Many a shop teacher can relate incidents of where he has recovered stolen tools, perhaps in the secondhand store downtown, because of unmistakable school marking on them. The marking usually consists of the name of the school or the initials of that name. Different processes are used to accomplish the marking. A very common one, and usually satisfactory, is to use steel letters or figures and stamp the marking into the metal parts. Stamping the wood makes the removal of the mark too easy. Some metal is too hard to be marked in this manner, but most tools and pieces of equipment can readily be so marked. Another method is to use acid to etch into the metal by placing a thin coating of paraffin on the portion to be marked and then cutting the inscription through the paraffin, thus causing the marking wanted to be etched into the metal. This takes longer than marking with steel letters, and it is more difficult to secure good results, and, of course, cannot be used on the wood parts of tools. A third method is to use an electric pen for marking which utilizes the principle of the electric arc by hooking one connection to the metal part to be marked and the other to the pen. This method is used with more or less success, but this method will not mark wood surfaces either. There are other methods of marking sometimes used, painting being one of them. Paint, however, is not permanent and can easily be removed. Whatever the method used, tools and equipment must be well marked to aid in controlling theft in school shops.

Recordkeeping. A very important factor in controlling theft in school shops is to have complete and accurate record-keeping systems, inventories, and checking out of equipment and tools for student use. Every efficient shop teacher will take inventory at the close of the school year, making a report of it to his superior with notations of losses and likewise make a check at the beginning of the school year. In checking tools in use by the classes at work in the shop, carefully thought out schemes must be inaugurated. In the keeping of tools, there are five commonly recognized methods: (1) bench tool racks, (2) bench drawers, (3) tool cabinets, (4) tool panels, and (5) toolrooms.

Bench tool racks are not difficult to check but they make theft easy when the teacher is not in the room. Tool drawers in the benches are not so easily checked but have the advantage that they may be locked when not in use. The tool cabinet is safe, may be locked, and each tool can have its place indicated by an outline painting on the back of the cabinet so that checking is easy. The tool panel makes checking easy but has no means of locking. The toolroom is the safest of all schemes, as the whole matter of loss at any time can be centralized in one lone individual instead of any suspicions as to guilt being equally applicable to every member of the class in which theft is noted. Most machine shops, where quite expensive equipment is used, use the toolroom for the reason that it is most effective in preventing theft.

In checking out tools from the tool-storage place different schemes may be used, depending on the particular situation. Metal checks are good and require little extra time in the securing of a tool. Blanks to be filled out in writing and deposited in place of the tool are also effective but require more time. With all tool-checking schemes the students are prone to get careless and they must be supervised by the teacher constantly to check indifference and carelessness. The teacher may delegate the supervision of tool checking to an organized monitor or foreman system composed of the boys in the class, and place on them the responsibility of retaining all tools without loss. This organization scheme is being given wide attention among shop men at the present time, and is recognized as a valuable character-building factor aside from the aid in handling routine in large shop classes that are becoming prevalent at this time. Every thoughtful shop teacher should give this organization scheme due consideration in relation to his shop, for it holds great possibilities and it is certainly very valuable in aiding in the control of theft in school shops.

Shop Housekeeping. No checking system used will function efficiently unless there is system and order in placement and storage of shop tools and equipment. There must be "a place for everything and everything in its place." Places where tools are kept must be plainly marked. One of the best schemes used is to paint the outline of the tool on the background where it is to be hung. Box or drawer tools for individual use must be numbered or otherwise marked so their place will be definitely known. Clamps should have rack space and so arranged that a glance will tell when all are accounted for. Machine accessories are best placed on panels mounted close to the machine. The outlines of these accessories should be indicated on the panels to make checking easy. Oilstones can be fastened down so that they are not easily removed. Oil cans can be chained to their place of use. Keys to tool drawers and cabinets must be deposited in some designated place, probably in a key cabinet, to which the instructor has sole access. Certain tools that are seldom used, such as combination planes, micrometers, spirit levels, and the like, should be placed in a separate place from the tools in everyday use and should be checked out by the teacher personally. Purchasing of cheap tools in certain instances where the high-grade tool is not necessary (some types of pliers, for instance) will make theft unprofitable to that extent. The continued use of old tools, even broken ones, where they can be welded or otherwise repaired and still do satisfactory work, instead of replacing them with new ones, will make the thief's potential profit less attractive. Shop-made equipment, such as bench hooks, T squares, triangles, clamps, etc., will not so likely be taken as manufactured trade-marked articles.

Shop Supplies. Theft of supplies, especially in a woodshop, may be quite as great as those of tools and equipment. In controlling this the general requirement, first of all, is again good housekeeping and businesslike methods of keeping records and inventories. Lumber may be subject to thefts and should be kept in a locked lumber room and cutting done under supervision of the teacher. Lumber must be charged to the student as he gets it. To prevent theft of stock from the boys while their article is in process of construction, requires that proper storage space be provided, and that care be taken that the boy marks his work plainly with his name. Finishing stocks may be kept in a locked cabinet and checked out to the student as needed to avoid theft. The finishing cabinet should be in a finishing room which may be locked also. Reserve brushes should be kept locked. The spray gun must be carefully taken care of as it is an especial temptation to the thief. To make assurance doubly secure, it may be well to disconnect it and lock it up in the finishing cabinet when not in use.

Hardware and sandpaper are probably most bothersome in the matter of theft control of all woodshop supplies. Nails may be taken in small quantities without being able to detect the loss. Screws may disappear by the dozen. One method of

checking this would be to deny the student access to the main supply or the whole box but to issue just the amount needed for the job. Some scheme should be used to make a specific charge as the hardware is issued if it is to be charged to the student. Designating some student to the custody of hardware and sandpaper and having him make charges to the student's account will be a very practical scheme to control theft of these items. A scheme that can be used to mitigate thefts of sandpaper is to save all discarded sandpaper to the end of the day and let the boys know that they may take this home for any use they may have for it. The instructor should also show leniency or be accommodating to certain boys who want just a screw or two or a few brads or nails for a little job at home. Thefts of hinges, locks, etc., may be controlled well if no stock of these articles is carried in the shop and the boy be required to purchase his own at the time needed.

Tool Borrowing. The borrowing of tools is a prolific source of loss of tools in many shops. The janitor is usually the chief offender in this case, although town people or outsiders sometimes seem to think they have special privilege in using public property. Other school departments look to the shop for necessary tools for odd jobs and it is a matter of courtesy to accommodate their needs. As far as possible, the lending of tools should be discouraged to all outsiders, particularly those not connected with the school. Careful records should be kept of all tools lent, preferably on a form. One of the simplest methods is to have available a separate rack of usable but discarded tools to supply the borrower.

Summary

In the matter of theft control in industrial-arts shops then, we can brief the problem by considering our responsibilities as industrial-arts teachers in the matter of subjective prevention by building up a deep confidence between students and teacher, and objectively, by putting the student in the situation of an active, responsible, participating citizen of the class in which his own pride, loyalty, and self-respect are at stake along with that of his fellows, thus appealing to the good impulses that are present in most boys. This is constructive control. Further, after attempting theft control from this altruistic angle, the shop teacher must set up the workaday environment and shop arrangement so that accurate and businesslike as well as comprehensive recordkeeping can be accomplished. This will provide an accounting for all supplies used and insure proper money returns from them instead of losses due to thefts, and will make possible the tracing and retrieving of tools and equipment that may be stolen. Good housekeeping in the shop, is also invaluable in the control of theft. Finally, what the teacher is, what he does, and how he does it, is a powerful factor with the plastic minds of boys. The key to any industrial-arts shopwork, is the teacher himself, and the greatest influence from this teacher comes not from precept but from example.

Reading of Trade Magazines in School Shops

William J. Patlow

Instructor of Printing, Vocational School, Milwaukee, Wisconsin

A description of the author's method of building up in his students the habit so few workers possess — that of regularly reading trade and professional magazines.

The worth-whileness of reading trade magazines is self-evident to progressive shop instructors. However, students need constant encouragement to read trade magazines so that they may see satisfactorily all of the things with which they will have a vital relation and responsibility if they continue in their chosen work. They must be shown how the possession of an adequate and larger vision of the field as a whole will give them the much-needed understanding of the difficulties and problems represented in the various interlinked divisions of any one large craft in which they are to play a part. When students understand that through the reading of trade magazines they will gain knowledge that will aid them to perform more efficiently the labors of their calling, get a better insight into the problem of production and distribution of the product which they help to produce, and obtain facts and stimulating ideas which will help them to keep their physical and mental powers on a higher level of efficiency, they will usually become interested enough to read and take home the trade magazines available. The students then become a part and parcel of the rich and vital field of human thought which is expressed in the pages of the trade magazine. Their viewpoints will be broadened so that their social relations with their fellow workers become more agreeable and effective. In other words, their work will be more capably and efficiently performed through increased technical and practical knowledge, right habits, and skills, all of which are stressed in these pages.

Trade Magazine Loan Record

Difficulty, from the viewpoint of the instructor, is often encountered when lending the magazine to students, testing the students on the contents of the magazine read, and

The Milwaukee Vocational School

Special Merit Trade Magazine Certificate

This Certifies

THAT _____

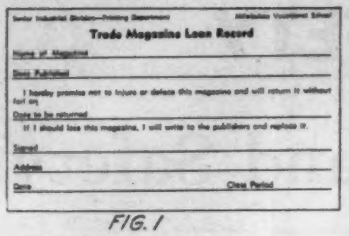
of the PRINTING DEPARTMENT is entitled to this testimonial due to the fact that he has read and reported on _____ copies of the _____ magazine

Issued this _____ of _____ 193____

_____

Instructor

Fig. 4. Special merit certificate


Trade Magazine Loan Record

Name of Magazine

Date Published

I hereby promise not to injure or deface this magazine and will return it without fail on

Date to be returned

If I should lose this magazine, I will write to the publishers and replace it.

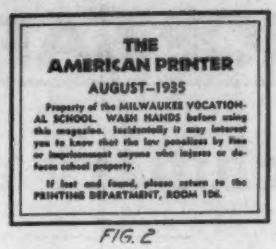
Signed

Address

Date Class Period

FIG. 1

Loan record card

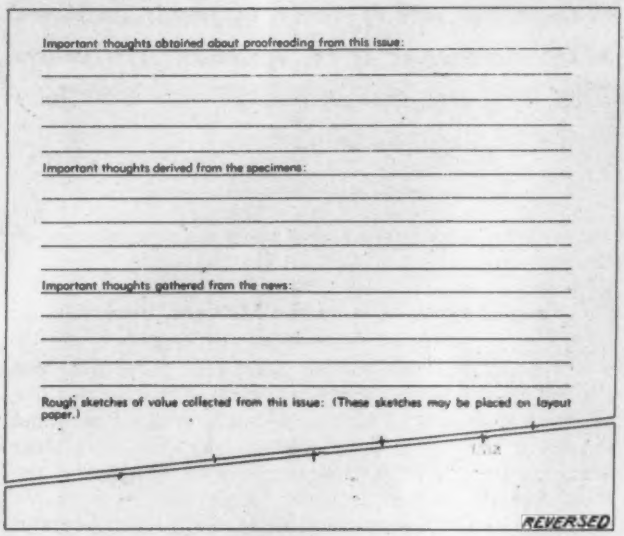

THE
AMERICAN PRINTER
AUGUST–1935

Property of the MILWAUKEE VOCATIONAL SCHOOL. WASH HANDS before using this magazine. Incidentally it may interest you to know that the law penalizes by fine or imprisonment anyone who injures or defaces school property.

If lost and found, please return to the PRINTING DEPARTMENT, ROOM 106.

FIG. 2

Sticker which is placed on each magazine


Important thoughts obtained about proofreading from this issue:

Important thoughts derived from the specimens:

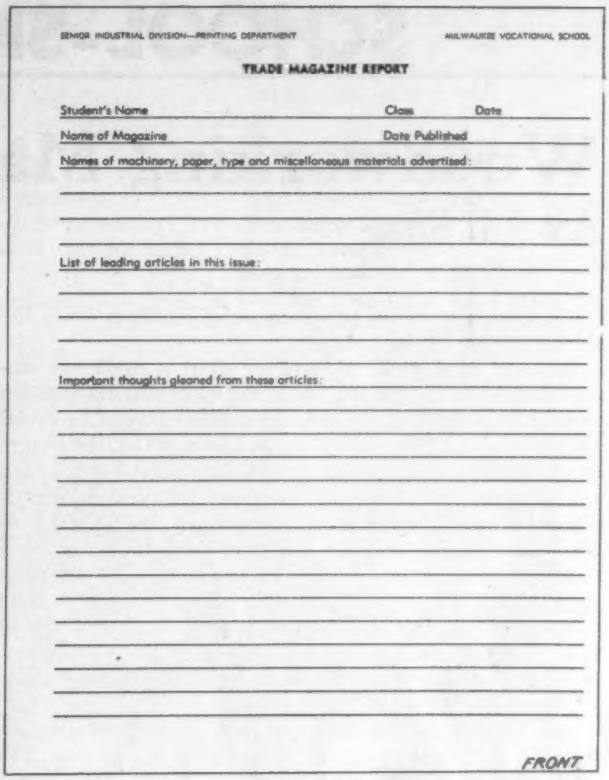
Important thoughts gathered from the news:

Rough sketches of value collected from this issue: (These sketches may be placed on layout paper.)

REVERSED

FIG. 3a

Reverse of the trade-magazine report blank


SENIOR INDUSTRIAL DIVISION—PRINTING DEPARTMENT MILWAUKEE VOCATIONAL SCHOOL

TRADE MAGAZINE REPORT

Student's Name Class Date

Name of Magazine Date Published

Names of machinery, paper, type and miscellaneous materials advertised:

List of leading articles in this issue:

Important thoughts gleaned from these articles:

FRONT

FIG. 3

Front of the trade-magazine report blank

giving credit for the work done. When a record, such as a "Trade Magazine Loan Record" as shown in Figure 1, is required of the students before they take the magazine home, the pupils are made to feel that they have a definite responsibility in keeping the magazine in perfect condition and also returning it on the date stated on the record. Furthermore, if they should lose the magazine, they have pledged their word to replace it. In order to emphasize the importance of not defacing or injuring the magazine while they have it in their possession, a sticker, as shown in Figure 2, serves a useful purpose when pasted on the cover of the magazine.

Trade Magazine Report

One of the greatest problems of the instructor is to find out whether or not students have actually read the magazine. The "Trade Magazine Report," shown in Figures 3 and 3a, requires students to list the names of machinery, materials, leading articles in the issue, important thoughts gleaned from the articles, important items found in the special sections, and other noteworthy things contained in any given number. This results in a report that is easily checked by the instructor.

Special Merit Trade Magazine Certificate

The issuance of a "Special Merit Trade Magazine Certificate" is also an effective method of stimulating the reading of trade magazines by students. This certificate may certify what has been read and reported on during a given period of time. The certificate, shown in Figure 4, in itself is valuable when applying for a job and can be shown when the employer desires proof that the applicant is really interested in the work.

Conclusion

The printing department of the Milwaukee Vocational School has used the forms mentioned in this article for the past year. A decided interest in the printing magazines has been noted. The students themselves are developing a background which gives them faith and confidence in their own ability. They know what is happening in the printing industry and can talk more intelligently about its present-day problems. Last but by no means least, the contact with the trade magazine is reflected by the improved work that is done by the students.

The teachers in the shop class have the future of the students' reading in their hands. The earnestness which they at present show in developing the habit of reading trade magazines and in helping the students to enlighten and strengthen themselves will be reflected in the advance and efficiency of the student. Without a doubt, the trade magazine is one means by which students can add to their technical and practical training and which has been the means by which more and more "journeymen" keep up to the times in their particular trades.

OPPORTUNITY

They do me wrong who say I come no more
When once I knock and fail to find you in;
For every day I stand outside the door
And bid you wake and rise to fight and win.

— *Malone*

SCHOOL-SHOP SAFETY

Woodworking Machinery and Safety

Axel J. Kise
St. Paul, Minnesota

Safety in the school shop must be emphasized at all times. For sake of clarity, no guards are shown in the illustrations of the machines. It is understood, of course, that all machines are to be fully guarded in the school shop.

The correct operation of woodworking machines forms the subject matter of this article.

Sufficient examples in pictures are given to enable the student to arrive at a fair understanding of the correct position to take at some of the principal machines he will be called upon to operate. Since the variety saw, the jointer, the planer, and the mortiser, are the machines most often found in the industrial-arts woodworking departments of the senior high school, all the illustrations in this article are confined to these machines.

NOTE: The pictures used in this article show the machines without guards, in order that the student may see the dangers involved in the different operations more clearly. Of course, it is understood that the guards must be in place before students are allowed to use the machines. This, in most cases, is required by state law.

The general rules of a school are flexible, and they are applied according to the temperament of the persons who made them. In the shop where power machinery is used, the conditions are different. The most important rules there are not made by man. Instead, each machine has its own set rules. The jointer, for instance, says, "If you put your finger into my knives when they are running, you will have it cut off." And the tragic part is that the jointer never fails to apply this rule. The ripsaw and the rest of the machines have similar rules, and they, too, always enforce them. The machine is never asleep on the job. It will not consider the inexperience of the beginner and take pity on him.

Given this sort of consideration, students are usually willing to listen to a lesson on the correct methods of handling the machines. They also must be brought to a realization that machines, even when properly safeguarded, are always dangerous to the careless operator. When using a machine, it is always necessary for the operator to concentrate on the particular operation at which he is engaged. He may not pay attention to any other activity whatsoever. He must not hurry if he wants to avoid accidents. All machines. of course, should be equipped with safety devices; with guards on belts and pulleys so as to eliminate the danger of injuring the operator.

No student should ask permission to use any of the machines until he has been shown how to use it properly through class demonstrations, or through individual instruction.

Careless or indifferent students should not be allowed to use machines at any time except under direct supervision of the instructor.

Keeping One's Eye on the Machine Prevents Accidents

A foreman in a woodworking plant, when asked what was the principal cause of accidents, answered that it was due to men trying to "look backward" while operating saws and planers or shapers. A momentary turn to speak to another worker or to see what is happening in some other part of the room and the damage is done. *"Keep your eyes on the machine"* is advice more valuable to the machine operator than is the rule "keep your eye on the ball" to the ball-player. The workman who calls out to a fellow worker engaged in sawing or planing is often responsible for a serious accident. One of the instructions which must be emphasized to each new man, and constantly reiterated to the veteran at the woodworking machines is, "Don't look backward or lose sight of your work for a second." Once the student understands this thoroughly, the danger from accidents is materially lessened.

SAFETY FIRST ! !
THIS MACHINE REQUIRES
THE OPERATOR'S FULL ATTENTION
PLEASE DO NOT TALK TO HIM ! ! !

Some time ago I noticed a young man who had lost a part of his first finger on his right hand. I asked him, "How did you lose your finger?" The answer came quickly, and without any of the air of one who is seeking sympathy, "In the school shop. Took advanced cabinetmaking in the high school, and slipped into the jointer."

This shows a sportsmanlike attitude pertaining to accidents that have happened after all reasonable safety precautions have been observed.

Wearing Apparel
1. Sleeves
   a) Tight
   b) Above elbows
2. Jacket
3. Overalls
4. Neckties
5. Rubber soled and heeled shoes

Safety Zones
1. Paint, sand, varnish
2. Asphalt, graveled roofing
   a) Tacked to floor
   b) On the level with floor

Sources of Accidents
1. Improper guarding
   a) Mechanical
   b) Personal common sense
2. Lack of judgment
3. Overconfidence
4. Carelessness
5. Rushing production
6. Dull tools
7. Tools improperly set up
8. Momentary oversight or thought-

lessness
9. Fatigue

Safety Signs to Be Placed Near Machines

Jointer
Dangerous machine
Keep guard in place
See to depth of cut
Use safety devices
Minimum length, 12 in.
Keep mind on work

Circular Saw
Dangerous machine
Before starting:
Beware of binding stock
Clamp fence securely
Use safety devices
Keep mind on work

Planer
Minimum length, 15 in.
Beware of heavy cuts
Listen to sound of machine
Avoid passing stock overhead
Keep pieces of stock behind each other
Avoid looking into throat

Band Saw
Listen for click of break
See to height of guide
Avoid backing up of stock
On the other side of saw, sign:
Danger area on this side

Lathe
Clamp tailstock securely
Clamp toolrest securely
Keep toolrest near stock
Hold chisel firmly
Avoid running belts
Replace push rod after using
Use low speed with large stock
Use paper washer with faceplate
Keep your mind on your work

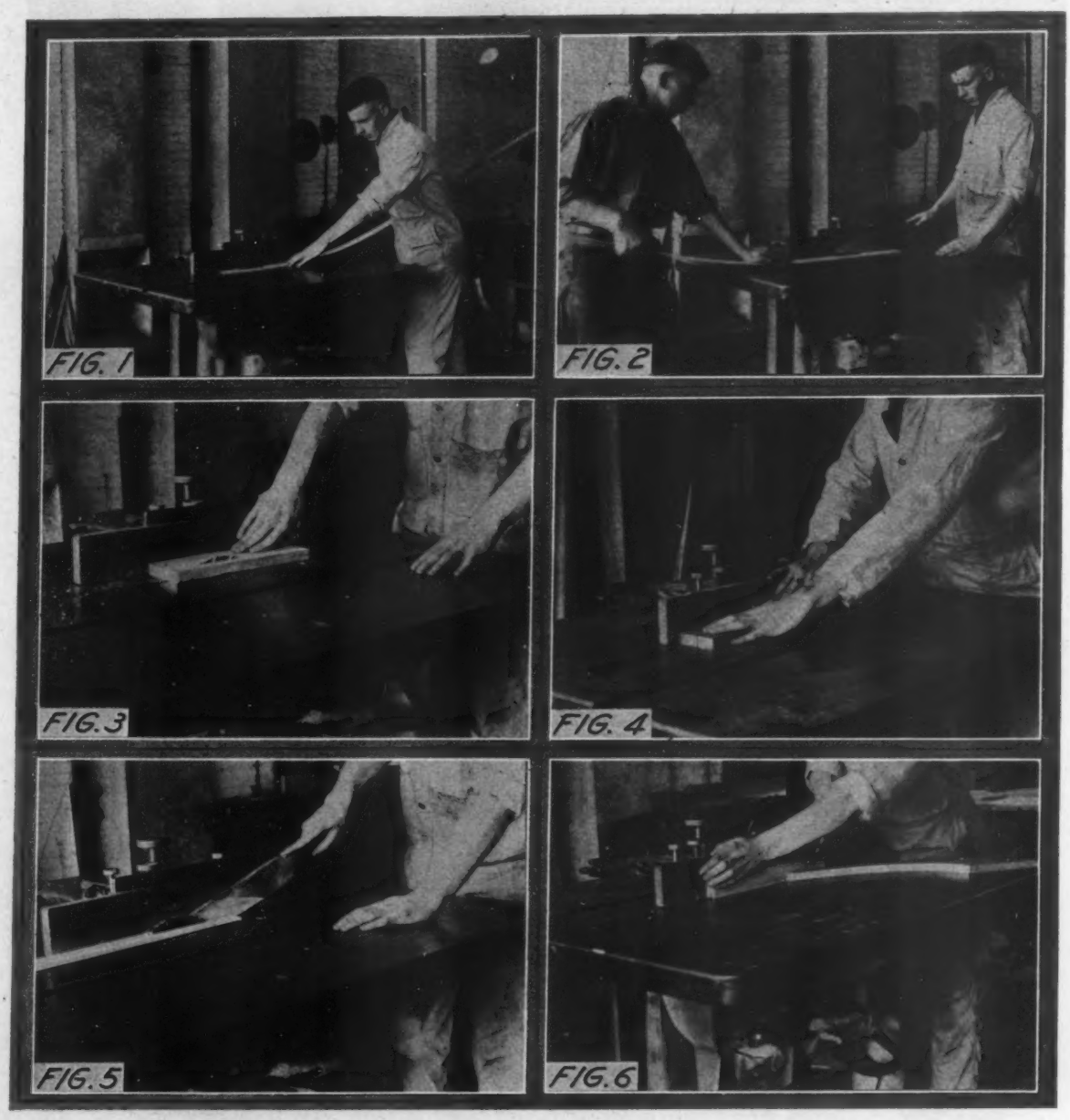


Fig. 1. Correct setup and position of feeder for ripping long, thin stock. Fig. 2. Correct position for off-bearing long, thin lengths. Fig. 3. Correct setup for ripping short lengths. Fig. 4. Dangerous position of left hand while ripping. Fig. 5. Correct setup and position for ripping narrow widths. Fig. 6. Correct setup and position for grooving stock. Both hands should have been in front of the saw. — NOTE: Guards were left off the machines pictured for the sake of clearness. Unguarded machinery must not be tolerated in the school shop

Mortiser
- Adjust for height carefully
- Clamp work securely
- Avoid crowding chisel
- See to clearance of bit

Swing Saw
- Use straightest edge
- Beware of twisted stock
- Use proper hand to pull saw, and to hold stock
- Avoid crowding saw
- Listen to sound of saw

Drum Sander
- Avoid heavy cuts
- Listen to sound of machine
- Keep fingers away from drum

Belt Sander
- Avoid heavy pressure
- Adjust for height carefully
- Use push board or float

Tenoner
- Dangerous machine
- Adjust cutter heads carefully
- Hold work securely
- Avoid crowding knives
- Listen to sound of machine
- Keep mind on your work

Power Grinder
- Wear goggles to protect eyes
- Keep fingers away from wheel
- Keep rest close to wheel
- True up wheel occasionally
- Do not stand in line with wheel
- Keep guard in place

General Shop Safety Suggestions
- Keep machines and parts oiled

Fig. 7. Setup for dropping stock over saw. Note: Block should have been clamped to table with operator on the the left side. Fig. 8. Correct setup and position for bevel ripping. Fig. 9. Correct arrangement for surfacing lumber. Fig. 10. Correct position of off-bearer and truck. Fig. 11. Correct setup and position for cutting stock to length. Fig. 12. Correct setup and position for cutting to length. Methods shown in Fig. 11 preferred. — NOTE: *Guards were left off the machines pictured for the sake of clearness. Unguarded machinery must not be tolerated in the school shop*

Use sharp knives and saws
Keep guards in place
Use safety devices
Avoid heavy cuts
Listen to sound of machine
Avoid loose clothing
Beware of binding and twisted stock
Keep floor free of scrap stock
Avoid talking while using machine
Keep mind on what you are doing
Carry ruler and pencil with you
Study individual machine rules

Routing Process

1. Ripping
2. Surfacing
3. Crosscutting
4. Jointing
5. Mortiser

Ripping Long Thin Stock

Figure 1 shows correct position of feeder in ripping long thin stock. The left hand holds the stock firmly against the guide and on top of the table directly in front of the saw. The left hand is held stationary and stock is pushed through with the right hand and in doing so, the right hand should be raised high enough to bend stock so as to force it to rest firmly on the table directly in front of the saw.

Figure 2 shows correct position of the off-bearer and feeder, also showing the finishing position. After the feeder has pushed the stock as far as possible, the off-bearer carefully picks it up, standing opposite feeder, and proceeds to pull stock through the saw. Figure 2 also shows correct position of off-bearer while pulling stock through saw. Left hand presses the stock firmly against guide and top of table and acts as a pivot, while the right hand raises the stock high enough to bend stock slightly, thereby forcing stock to follow surface of top directly in front of the saw.

OIL YOUR MACHINES

Ripping Short Lengths

The variety or universal saw is one of the most dangerous machines and the guard should be kept over saw at all times, except, of course, in dadoing, when it cannot be used.

Figure 3 shows the correct position of ripping short lengths. The position of the operator's hand in doing this work is typical of all ordinary ripping. Notice that the right hand is at the lower right-hand corner of the piece being ripped and the palm of the hand resting on top of the fence. The left hand is resting on top of the table of the saw helping support balance of body and far enough away from the dangerous saw.

The guard has been taken off to enable you to see the proper projection of the saw about ⅛ in. above the surface of the board. The saw should always be adjusted just to come through the material, never far above it, as there will be more chance of being caught if it projects far above surface of stock being ripped as shown in Figure 5.

Figure 5 shows the use of the push stick instead of the right hand. It is much safer and just as good. One should always use a push stick when ripping narrow stock 4 in. or less.

Figure 4 shows operator in a dangerous position. Right hand is in correct place, but left hand should not be placed behind the saw, as the saw might at any second kick the stock toward the operator and carry the left hand with it into the saw unless the guard is in place. Feed the stock slowly and push it way through with your right hand, then with your left make a swing to the left far enough away from the cutting zone and advance to the surplus stock behind the saw, but do not pass your hand over the saw at any time. Always keep far enough away when picking up surplus stock.

Figure 3 shows correct position of operator in ripping short lengths.

Points to Be Observed While Operating Saw

1. The crosscutting fence usually used for cutting stock to length, Figure 11.
2. Always use a clearance block on the ripping fence when using it as a stop while crosscutting, Figure 12.
3. Have the saw only as far above the table as necessary for the stock which is to be cut.
4. Always clamp stops on the table when cut is shorter than length of stock, Figure 7.
5. Do not adjust the fence while the saw is in motion.
6. When ripping stock, be sure that the edge is held against the fence.
7. Do not stand back of the piece as it passes over the saw, but keep to the left of it (if thrown back, it will injure you seriously).
8. Make sure that the handwheel and fence are clamped before starting the saw.
9. Beware of crowding the stock and binding the saw.
10. Use a push stick when ripping narrow or short stock.
11. Do not pick up pieces from the table when the saw is in motion: use a stick to push or rake it off.
12. Do not use a dull saw: it is both costly and dangerous.
13. Stop the saw when you leave to do an errand in another part of the shop, or while you use another machine.
14. Keep trimmings off floor and machines and place them in box trucks.

OIL YOUR MACHINES

Grooving

Figure 6 illustrates the operator cutting a groove in the edge of board. The position of the left hand as shown in this illustration is incorrect. The left hand should hold the stock just in front of the saw.

Particular attention is called to the spring guide which is made out of wood and clamped to the table. This holds the material against the guide and insures accuracy.

OIL YOUR MACHINES

Saw Kerfing

Kerfing on a variety saw bench is done by adjusting the saw or the table so that the saw cuts only partially through the thickness of the wood.

Figure 7 shows the operator cutting kerf in the underside of a board. Notice that the left hand is placed ahead of the right and holds the stock down firmly while it is pushed over the saw with the right hand. Note the use of the stop block clamped to the table. This enables one to get all the kerfs the same on each board and prevents the saw from kicking the board forward.

Figure 7 also shows the operator standing back of the saw, which is wrong. He should stand to the left of the machine near the front of the table.

OIL YOUR MACHINES

Bevel Ripping

For bevel ripping with tilted table, the fence should be on the lower side of the saw, Figure 8.

Figure 8 also shows correct position of hands. The table is tilted to the required degree, with the saw. The position of the right hand should be at the upper right-hand corner of piece being ripped and the left resting on the fence. The left hand should feed and guide the stock, leaving the right hand free to dispose of the surplus.

Thicknessing Stock

The stock, after being faced on the jointer, Figure 19, is finished on the other side and brought to the required parallel thickness by passing it through the planer or surfacer.

Two persons are employed in this operation on the single surfacer, one to put the stock into the machine and one to take it away. The former is called the feeder, and latter, off-bearer.

Figure 9 shows only one board being planed at the time, although with sectional feed rolls, several pieces can be planed at once even if stock varies in thickness. The construction of the upper front feed roll being in section which yield independently of each other permits this, thereby enabling the use of the full width of the machine on narrow stock. The old-style machine with single roll would not permit passing more than one piece through at the time.

The surfacer is one of the largest machines used in the school shop, but one which the senior-high-school boy can operate with reasonable safety.

Figure 9 shows the correct placing of the truck with lumber to be planed; also correct position of feeder. Note that the feeder has his left foot slightly forward, also feeding stock facing truck or on the left side of the board being fed. This will enable the feeder to be within direct reach of the feed lever in case something goes wrong.

The feeder should pick up the stock holding it at the center of its length and feed it into the planer lifting the outer end of the board above the level of the planer bed, as Figure 9 shows. One has better control of the stock this way and less danger of being hurt if the board is kicked back which might happen at any time.

Figure 10 shows the correct placing of truck and correct position of the off-bearer. The off-bearer takes hold of the board at the center of its length as it comes out of the planer. Note that the board is between the off-bearer and truck. This enables him to place the board on the truck more quickly so as to be in place for the next board.

Do not pull on the board that is coming through, as the feed rolls work only so fast and there is no need of pulling, only support the board by springing the outer end above level of planer bed, and when weights let go of the board, place board on the truck and be in place for the next one.

Points to Be Remembered

1. Remember that the feed can be stopped instantly by loosening the feed lever.
2. Do not leave the machine running when you are through using it or while going on an errand.
3. Do not plane pieces less than 16 in. in length.
4. Never plane two pieces side by side on a single feed roll.
5. See that this machine, as well as others that you use, is properly oiled at all times.
6. In starting the motor, be sure that the planer is at its maximum speed before you throw the feed into gear.
7. If there is a shaving exhaust, be sure that the hood is in place and the fan is started as you begin work, and dampers should be wide open.
8. Do not do all of the cutting at one place on the knives when narrow work is being planed. Distribute it equally throughout the length of the

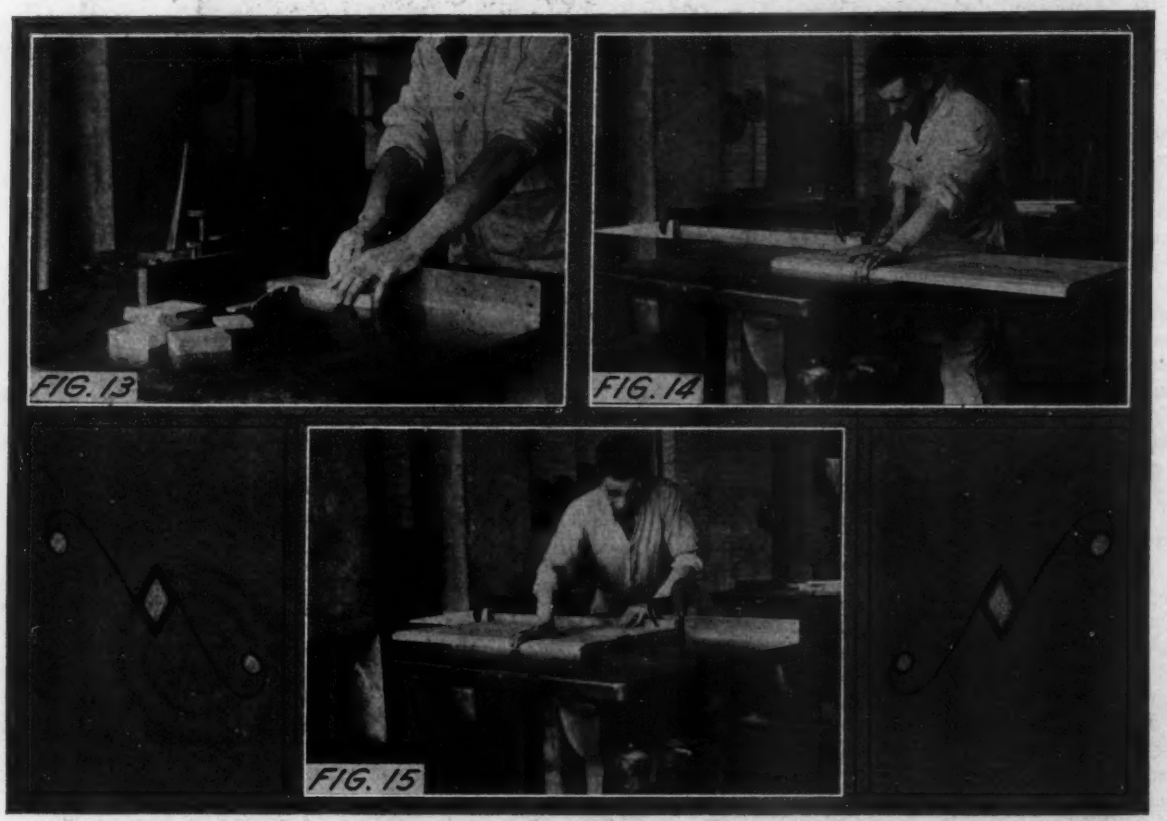


Fig. 13. Incorrect sawing to length. Fig. 14. Correct setup and position for crosscutting first end. Fig. 15. Correct setup and position for cutting to length and squaring other end. — NOTE: *Guards were left off the machines pictured for the sake of clearness. Unguarded machinery must not be tolerated in the school shop*

knives so that they will wear down and dull evenly.

9. Exercise judgment relative to depth of cut to be taken. Remember it is easier on the machine to go through once taking 1/16-in. cuts than it is to force it through taking ⅛-in. cuts.

10. Remember that if the planer begins to slacken speed or to check, the feed may be stopped by means of the hand lever and so left until the cylinder gets up speed again. On hard wood, the knives are likely to burn if stopped too long.

11. When feeding the stock through the planer, do not get behind the moving stock since, if the stock is thrown back, which occasionally happens, the operator may be severely injured. Keep to either side of the stock.

OIL YOUR MACHINES

Cutting to Lengths

This operation shows a common use of the variety saw in conjunction with the crosscutting fence and stop for gauging length.

The operator in Figure 15 is cutting tops for typewriting desks to length. In the school where this photograph was taken, they do production work; that is, they make desks and tables in lots of six or more at a time. Hence, the operator while on this job will cut

Fig. 16. Correct setup and position for jointing edges of short lengths. Position of left hand incorrect. Fig. 17. Correct setup and position for jointing short and narrow stock using push stick. Fig. 18. Correct setup and position for jointing stock flatwise. Position of left hand incorrect. Note use of wooden mitten. Fig. 19. Correct setup and position for jointing short stock flatwise. Note use of two wooden mittens. Fig. 20. Correct setup and position for starting to joint a straight edge on a long stock. Fig. 21. Correct position for continuing the cut started in Figure 20. Stock must follow rear table. NOTE: *Guards were left off the machines pictured for the sake of clearness. Unguarded machinery must not be tolerated in the school shop*

to length all the tops. The stop gauge is fastened to the cut-off-gauge bracket which slides in a T slot on the table.

In this operation the hands serve a double purpose of holding the material against the fence and pushing it past the saw. Figure 14 shows operator sawing off one end and Figure 15 sawing top to length.

Figure 13 shows incorrect operation of cutting to length. Here the stock is placed against the ripping fence and pushed past the saw, but the great danger here lies that the block being sawed while passing through the saw and fence has the tendency to pinch and the motion of the saw will throw the block back endangering operator.

A much better and safer way would be to place a stop in front of the saw. Clamp on the fence as shown in Figure 12, then slide the stock up against it, hold stock firmly and at the same time push the stock past the saw. This operation is much better and safer, as it leaves a clearance between the end of the stock and the fence, thereby preventing the pinching of stock and the great danger of stock flying back at the operator.

The operator should remove each block immediately after it is cut off and place them on the truck so that they will not accumulate, as shown in back of the saw in Figure 13.

Figure 11 shows the correct position of hands as they push the stock past the saw, also the correct use of the stop block for cutting to length, clamped to the cut-off fence.

OIL YOUR MACHINES

Jointing an Edge

Making a working edge on the jointer is similar to squaring up a working edge at the bench.

The face side is held against the fence and fed very slowly.

If the stock is so wide that the top edge comes above the fence, it will not be necessary to use the mitten or push stick shown in use in Figure 17. But for the short, narrow, or thin stock, one should use a push stick and mitten.

Figure 16 shows incorrect position of left hand. It should rest on the fence while holding the board firmly on the surface of the jointer. See that your hand never passes over knives unless you have a wooden mitten or your hand resting on fence.

Figure 17 shows the correct standing position and use of push stick.

Feed short stock slowly. It is best to feed the stock so that the knives will cut with the grain, however, fairly good work can be done jointing against the grain if fed very slowly.

Points to Be Observed While Operating Jointer

1. Be sure that the back table is properly adjusted and locked, and that the fence is fastened so as to give the angle you are attempting to cut.
2. Use a guard at all times except when rabbeting.
3. Use a wooden mitten or push stick of some kind in pushing flat and narrow stock over the revolving cylinder.
4. Do not change the fence when the cylinder is in motion.
5. For good work, push the stock over the jointer slowly (about 15 feet a minute). It is best to have the knives cut with the grain.
6. For straight cutting be sure that the stock follows the rear table. This means to make it follow the rear table from the time it leaves the jointer head.
7. When jointing a board with a convex edge, start with the forward end upon the rear table. If the concave edge

Fig. 22. Correct setup and position for tapering. Kick stop should have been clamped on table. Fig. 23. Showing correct position of holding stock. Figs. 24 and 25. The results of disregarding the laws of woodworking machines. NOTE: *Guards were left off the machines pictured for the sake of clearness. Unguarded machinery must not be tolerated in the school shop*

is to be jointed, start at the center and work toward both ends alternately.

8. If the rear table is too high, it leaves a crowned edge; if too low, a hollow edge.

9. Do not use a jointer for sizing to thickness. After the working face has been cut, the stock should be taken to the planer.

OIL YOUR MACHINES

Facing Off Stock

Facing off stock is preparing one of the surfaces so that it will lie flat as it passes through planer when thicknessing. This operation is done on a jointer, sometimes called buzz planer.

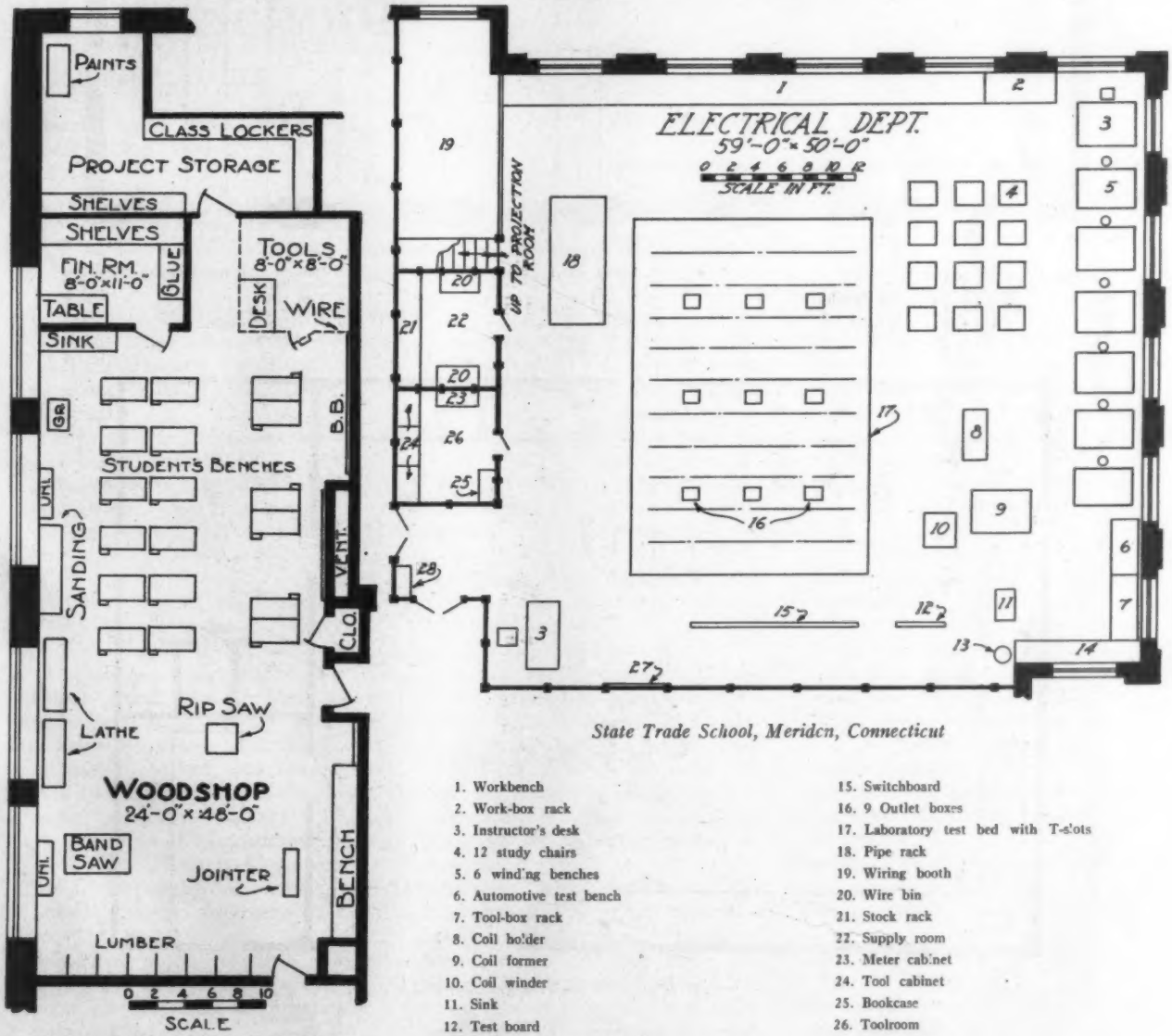
In order to give good balance to the body and to insure perfect control over the work, the operator should stand in front of the cutter head, with body bent slightly forward, with left foot forward and right foot to the rear, and with the use of wooden mittens resting on the piece as shown in Figure 18, so that the left hand is pushing directly away from the jointer head, while feeding stock with right hand.

The left arm, Figure 19, should be straight and firm to help guard against the stock from making a sudden flop back. Figure 18, shows only one mitten in use and left hand holding the front end down without the use of the mitten. This is not a good practise, for sooner or later the board might take a sudden jump, and with your bare hand pressing it down, might result in the board twisting and your fingers will be caught in the cutter head.

Always use two mittens while facing off stock longer than one foot, as shown in Figure 19; or if you take a chance, as many do, you will some day find

(Continued on page 69)

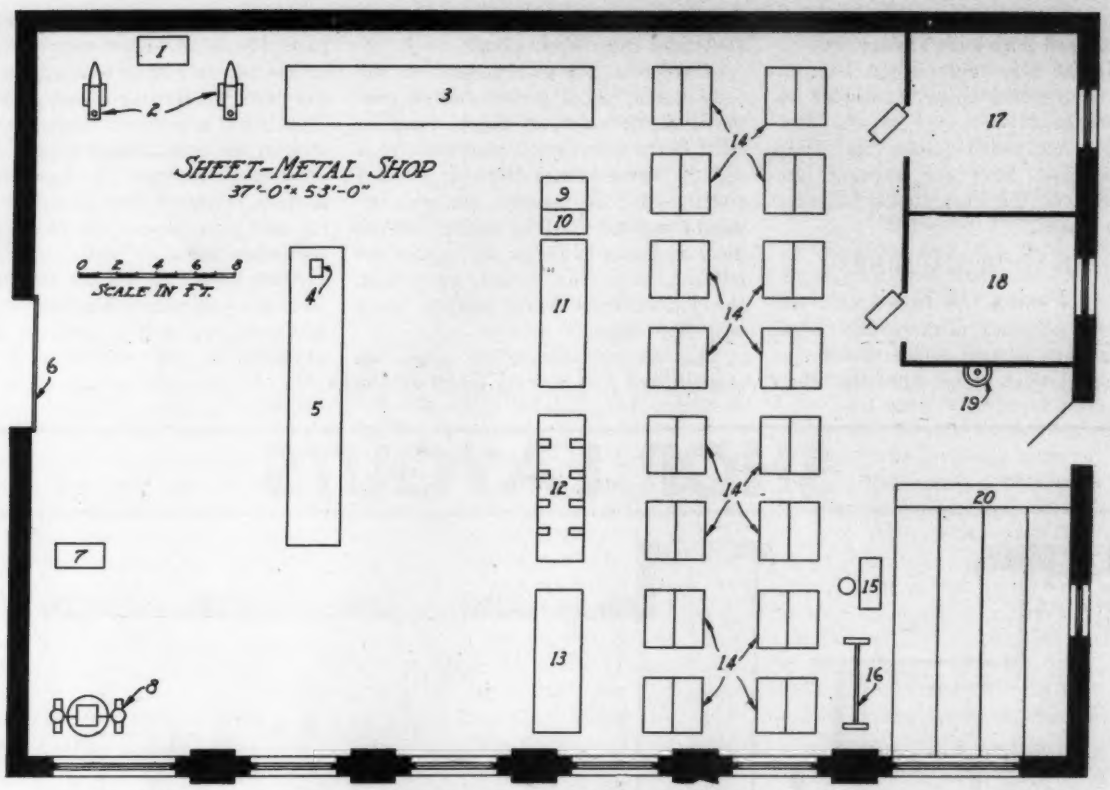
SHOP LAYOUTS



Upper Darby Junior High School, Upper Darby, Pennsylvania

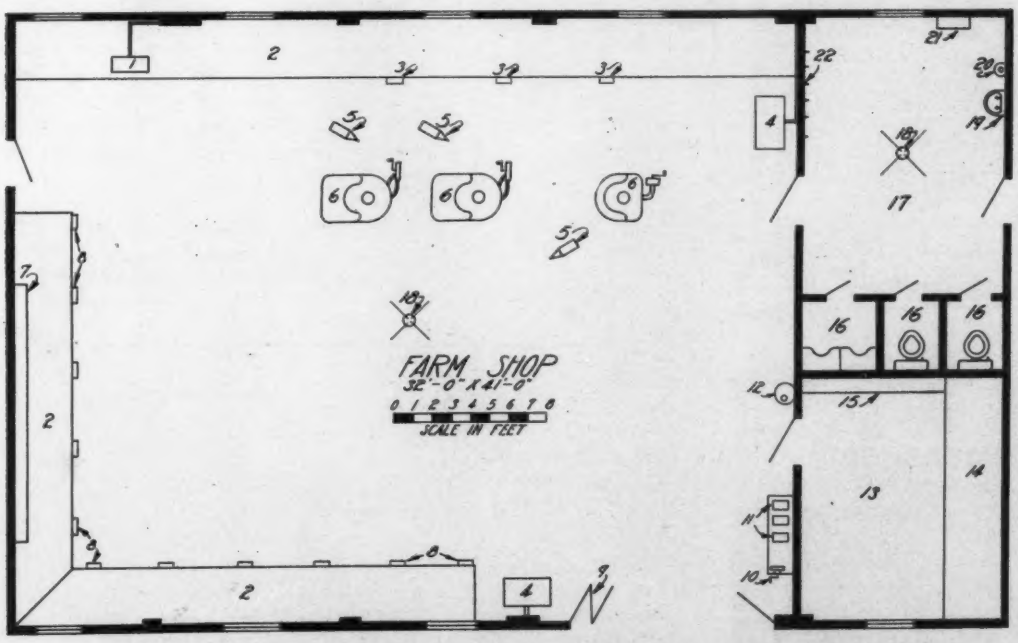
State Trade School, Meriden, Connecticut

1. Workbench
2. Work-box rack
3. Instructor's desk
4. 12 study chairs
5. 6 winding benches
6. Automotive test bench
7. Tool-box rack
8. Coil holder
9. Coil former
10. Coil winder
11. Sink
12. Test board
13. Oxygen tank
14. Battery bench
15. Switchboard
16. 9 Outlet boxes
17. Laboratory test bed with T-slots
18. Pipe rack
19. Wiring booth
20. Wire bin
21. Stock rack
22. Supply room
23. Meter cabinet
24. Tool cabinet
25. Bookcase
26. Toolroom
27. Blackboard
28. Cabinet



Abraham Lincoln Junior High School, Des Moines, Iowa

1. Forge
2. Anvils
3. Gas-furnace bench
4. Pipe vise
5. Plumbing bench
6. Overhead door
7. Power saw
8. Emery wheel
9. Shears
10. Scrap box
11. Layout table
12. Machine bench
13. Stake bench
14. Workbenches
15. Desk
16. Blackboard
17. Tool crib
18. Supply room
19. Drinking fountain
20. Washbowls



Casper High School, Casper, Wyoming

1. Gas soldering furnace
2. Workbench
3. Blacksmith's vise
4. Gas stove
5. Anvil
6. Forge
7. Display board
8. Wood vise
9. Folding door
10. Emery wheel
11. Sharpening stones
12. Post drill
13. Toolroom
14. Tool board
15. Supply cabinet
16. Lavatory
17. Washroom
18. Drain
19. Washbowl
20. Drinking fountain
21. Towels
22. Clothes rack

(Continued from page 67)

yourself without some of your fingers, as shown in Figures 24 and 25.

OIL YOUR MACHINES

Tapering

Figure 22 shows one of the many uses of the jointer. The operator is using a stop block clamped to the table for tapering the lower end of the desk leg. Notice the position of the hands of the operator in this work. The left hand is placed behind the cutter head holding the leg firmly against a gauge and top of the table, while the right hand feeds the stock.

The Steps Involving Tapering

The bottom of the leg is placed against stop block and held firmly while the top end of the leg is held above table. Then the top is lowered slowly toward the cutting head until stock rests firmly on the table. Next, push the stock over cutter head very slowly while holding stock firmly against the guide and top of table.

OIL YOUR MACHINES

Mortiser

Figure 23 shows the correct position of the operator in using the hollow-chisel mortiser. Note the position of the hands while holding stock on rest.

SHOP COURSES

Course in Electricity for the Junior High School

Tilden Collar

Montauk Junior High School,
Brooklyn, New York

The course outlined in this article also lists the projects, the method of teaching related information, and references. It is intended for a semester's course (20 weeks).

This course of study, it is hoped, will assist the teacher in more fully organizing his work and his teaching procedure.

The work is intended to occupy one semester (20 weeks) in the junior high school.

Suggestions to the Teacher

In shop classes no teaching device can compare with a skillfully executed demonstration. Class and group demonstrations should be given frequently, followed by individual instruction.

Individual job and instruction sheets should be used as instructional aids only.

Theoretical instruction should be given in short units when needed, rather than in the form of long lectures.

Motion pictures may be used at opportune times.

Short information and performance tests should be given from time to time in order to determine pupil progress, to diagnose teaching difficulties, and to stimulate interest. An individual record of progress should be kept for each pupil.

It is not expected that each pupil will complete all instructional units listed in this course.

The skillful teacher will make use of the variety of work offered to provide for the different aptitudes and interests of individual students.

Objectives of the Course

Study community needs; obtain command of fundamental processes; learn how to use one's leisure in a worth-while manner; study how to retain one's health; become acquainted with the developmental values, exploratory values, guidance values, and consumer's values offered in a course of electricity; acquire "handy-man" abilities.

Outline of Instruction

I. The Electric Circuit

Theory. The source of current, the path of current, the control of current; the use of current.

Information. Wiring symbols, wiring operations, uses of electricity in the home, electrical units and Ohm's law, tools and their uses.

Practice. Assembling extension cord, construction of strap key, construction of buzzer, splicing wires, installation of simple bell circuit, extending length of lamp cord.

II. Conductors

Theory. (1) Good conductors of electricity, materials in common use, protection of conductors. (2) Poor conductors. Material commonly used, heating effect of poor conductors, everyday use of this effect. (3) Nonconductors. Materials commonly so recognized, special value of nonconductors.

Information. Origin, growth, and history of the industry; raw materials: sources, transportation, preparation, manufacture; commerce, cost, and geographical aspects.

Practice. Construction of conductivity tester. Test the following materials for conductance: copper, aluminum, zinc, brass, iron, tin, lead, nichrome, nickle, German silver, charcoal, coke, distilled water, drinking water, salt water, acid solutions, linen, wood, living substances, shellac, sugar water, slate, oils, porcelain, leather, paper, wool, silk, mica, glass.

III. Electrical Testing and Meter Reading

Theory. Testing polarity with a compass the order and sequence of "trouble shooting," how to read the watt-hour meter.

Practice. Construction of simple testing apparatus: fuse tester, circuit tester (3-volt), circuit tester (110-volt), galvanoscope.

IV. Generation of Electric Current

Theory. (1) Chemical generators: wet cells, container, poles, solution, action. Dry cells: zinc, carbon, medium. Storage cells: container, plates, solu-

tion, action. (2) Magnetic generators: dynamos, magnetos. (3) Heat generators: thermocouples.

V. The Relation of Magnetism to Electricity

Theory. (1) Magnets: natural, artificial, electro. (2) Magnetic properties: polarity, attraction and repulsion, magnetic induction. (3) Rules of polarity: magnetic field, electrical effects of magnetism, magnetic effects of electricity.

Practice. Construction of simple magnetic apparatus — silent telegraph, telegraph buzzer, electric top, code practice set, toy motor.

VI. Circuit Connections

Theory. Batteries in series, bells in series, lamps in series, batteries in parallel, buttons in parallel, bells in parallel, lamps in parallel.

VII. Practical Bell Circuits

Practice. Return-call circuit, double-call circuit, single-house circuit, combination circuit, duplex-house circuit, annunciator circuit, connecting 3 bells and 3 buttons, day and night circuit, burglar-alarm circuit, blinker circuit.

VIII. Guidance

Information. Study of occupation; study of opportunities offered; study of pupil interest, capacity, ability, and skill.

Proposed Projects

1. Western Union splice.
2. Tap splice.
3. Tinning a soldering copper and soldering a splice.
4. Dry-cell construction.
5. Dry cells connected in series.
6. Dry cells connected in parallel.
7. Construction of an electromagnet.
8. Application of Ohm's law.
9. Simple bell circuit.
10. One push button to ring two bells in parallel.
11. One push button to ring two bells in series.
12. Two push buttons to ring a bell and buzzer separately.
13. Two-wire return using plain push buttons and two batteries.
14. Annunciator circuit.
15. Assembling lamp extension cord.
16. Assembling an electric iron or heater extension cord.
17. Connect a feed through switch to an extension cord.
18. Finding, testing and replacing fuses.
19. Lighting circuit lamps connected in parallel.
20. Light circuit, two-point control switches.
21. Lighting circuits, ceiling light controlled by flush switch.
22. Wall light with pull-chain socket.

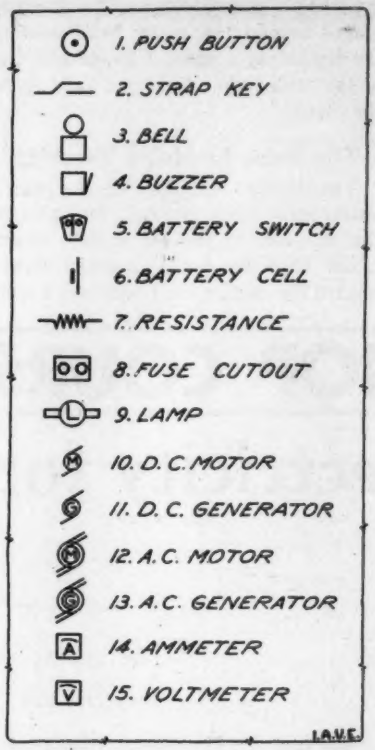


Fig. 1. Electrical symbols

23. Push button or strap key.
24. Magnetic buzzer.
25. Small electric two-pole motor.
26. Simple electric engine.
27. Soldering copper.
28. Arc type soldering iron.
29. Toaster.
30. Transformer.
31. Day and night circuit.
32. Return-call circuit.
33. Burglar-alarm circuit.

Lesson Outlines

I. The Electric Circuit

Parts of a Circuit. Source, path, control, load.

Method of Teaching. Blackboard illustration, demonstration with model, oral explanation.

Proposed Projects. Extension lamp, table lamps.

II. Electrical Testing

1. The order and sequence of "trouble shooting."
   - *a*) Source: battery or transformer.
   - *b*) Path: circuit wires, source wires.
   - *c*) Control: push buttons, strap keys, switches, starting boxes, controllers.
   - *d*) Load: bells, buzzers, lamps, heaters, irons, motors.
2. How to use a fuse tester.
3. How to use a circuit tester.

Method of Teaching. Blackboard illustration, demonstration with model, oral explanation.

Proposed Projects. Fuse tester, circuit tester.

III. Electrical Symbols

Method of Teaching. Oral explanation, job sheets.

Proposed Projects. Strap key, battery switch, nichrome resistance.

IV. Electrical Units

1. Ampere	Unit of current
2. Milliampere	One thousandth ampere
3. Volt	Unit of pressure
4. Ohm	Unit of resistance
5. Megohm	1,000,000 ohms
6. Farad	Unit of capacity
7. Microfarad	One millionth farad
8. Watt	Unit of power
9. Kilowatt	1000 watts
10. Watt-hour	1 watt per 1 hour
11. Kilowatt-hour	1000 watt-hours
12. Horsepower	746 watts
13. Henry	Unit of inductance

Method of Teaching. Oral explanation, job sheets.

V. Bell Wiring Operations

1. Straightening the wire.
2. Placing the staples.
3. Making a helix.

Procedure: (1) Fasten bell to the panel board. (2) Cut wire to length after deciding the location of the push button and battery. (3) Remove insulation from ends of wires. (4) Fasten wires to push button and screw in place. (5) Fasten wires to bell and battery as directed. Wires must be run horizontally and vertically and held in place with staples.

Methods of Teaching. Oral explanation, demonstration.

VI. Uses of Bell Circuits in the Home

Simple bell circuit, telegraph, call bell, tester.

Method of Teaching. Oral explanation, demonstration.

Proposed Projects. Electric buzzer.

VII. Tools and Their Uses

Method of Teaching. Oral explanation, demonstration.

Proposed Project. Simple bell circuit.

VIII. Ohm's Law

E = Electromotive force, I = Quantity of current, R = Resistance.

A plumber must be able to calculate the water pressure and the rate of flow of water through any given pipe. So, too, the electrician must calculate the electrical pressure and the rate of flow of the current. The electrical pressure is called voltage. It is also called electromotive force (e.m.f.). The unit of measure is the volt. The electrical rate of flow is termed amperage. The unit of measure is the ampere.

(Continued on page 11A)

Huther Bros. Saw Mfg. Co.

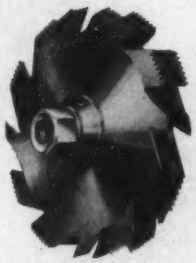
1290 University Ave., Rochester, N. Y.

Manufacturers of

Circular Saws, Groovers, Band Saws

Huther Bros. Saws are the result of more than sixty years' successful and uninterrupted experience in the manufacturing of saws. Each saw embodies the highest type of workmanship and is backed by a guarantee to be as free from flaws and seams as possible. Complete catalog on request.

Dado Head



Our dado head developed from our own patents cuts grooves with or across grain, smooth, sharp sides, grooves from ⅛" up to 4" and over. Easily adjustable. Consists of 2 outside Cutters ⅛" thick and inside cutters to make desired cut. Inside cutters in 1/16", ⅛" and ¼" thicknesses. These Groovers make a perfect cut and leave the bottom smooth.

Angular Hub Groover

(New Patent No. 1782507)

This Groover was designed to cut end grooves in hard wood and to clear itself easily without swage or set. Clearance is effected by angular grinding of hub. Light adjustment. Used on regular saw mandrel without extra collars.

High Speed Knives

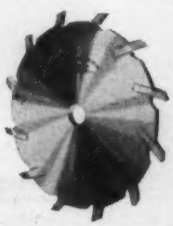
Shaper Stock, Ground Flat Stock

We manufacture thin High Speed Steel Knives, Solid Moulder Knives from High Speed Steel or Special Laid Steel. We can also furnish ground stock in various thicknesses and widths, square edges, in High Speed or best quality Tool Steel.

Band Saws

We make both wood and metal cutting band saws, also special temper saws for fibre, bakelite and soft metals. Let us know what you cut and we can furnish a saw for the purpose.

Inserted Tooth Groover



This is the perfect Groover for end grain cuts in hard wood. Teeth are High Speed Steel, front to back clearance, and require grinding on top only. Cuts full width groove through life of teeth. Teeth can be replaced.

New Steady Rim Rip

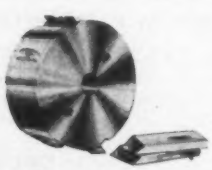
This is an extra smooth cutting Rip Saw designed for smooth cutting at fast feed. This is the smoothest cutting Rip Saw we have and is capable of beautiful work.

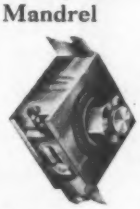
Saw Vise

Setting Stake

These are useful articles for the filing room and were both developed for use in our own filing department. Vise is easily adjusted for various bevel filing and takes saws up to 18" diameter.

Cutter Heads for Saw Mandrel





Cutter Heads for use on saw table. These heads can be furnished with variety of knives and used for jointing and running light moulding on saw table. Made in 6" diameter, 2¼" wide. Can be counterbored if necessary.

Mitre Saws

Our Mitre Saws are accurately ground with the proper side clearance and are made in six styles of tooth shape. Cleaner Tooth Saws are for both rip and cross-cut—made in diameters from 4" to 24".

Woodworking Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Bench
- *a*) Shop, with hardwood tops, 1¾ in. or over in thickness, built up of strips with tongue-and-groove joints, the top to project far enough to allow a rapid-acting or continuous-screw vise to be attached.
  It is a good idea to order a 1-in. birch or maple board wide enough to cover the working face of the bench at the time of buying the benches. This board can then be fastened to the top proper with screws and may be conveniently replaced when worn. The benches should be made of thoroughly kiln-dried lumber throughout. They may be either plain or of 6-drawer type.
- *b*) Glue
- *c*) Stain, with metal-covered top
- *d*) Teacher's demonstration

Blackboard — permanent or portable

Bookcase

Bulletin Board

Cabinets — wood or metal for filing class records, instruction sheets, drawings, etc.

Chairs — teacher's and tablet-arm

Core Oven — for patternmaking class

Desk — teacher's, with drawer compartments

Furnace — for melting soft metals (for patternmaking class)

Glue Pot — 1-qt. or 2-qt. electric, gas, or steam heat

Glue Warmer or Cooker — 1- to 5-gal. capacity

Grinder
- *a*) Automatic knife, direct-motor-drive type. Size to suit largest knife used in school shop, complete with water pump, grinding wheel, and automatic stops
- *b*) Bench, hand or power
- *c*) Bench, motor-in-head. Motor bearings to be completely housed, wheels to be equipped with safety flanges and carefully guarded throughout. One fine-grit, and one coarse-grit wheel
- *d*) Revolving oilstone, pedestal type, with one fine and one coarse oilstone

Jointer
- *a*) 6-in. or 8-in. portable jointer. Table to be fitted for rabbeting. Safety-cylinder type, equipped with safety guard
- *b*) 12-in., 16-in., or 18-in. direct-motor-drive, ball-bearing. Cylinder to be of safety-head type. Table to be fitted for rabbeting. Jointer to be equipped with safety guard

Lantern — Stereopticon-view machine for opaque objects and standard-type lantern slides

Lathes
- *a*) 6-in. to 16-in. motor-in-head, motor-in-base, or belt-driven speed lathe, to take 24 in., 36 in., 48 in., 60 in., or 72 in. between centers. Each to be complete with cup center, spur center, faceplate, rosette chuck, tool rests, and center drift for head block
- *b*) Patternmakers', with end faceplate provision. Lathe to be of direct-motor-drive type, equipped with variable-speed motor, faceplates and floor stand. (For patternmaking class)

Mortiser
- *a*) Direct-motor-drive, or belt-driven, hollow-chisel mortiser, foot feed. Table to be of the tilting type with hold-down clamps and stop rod
- *b*) Portable, vertical, hollow-chisel mortiser, bench type

Planer — 12-in., 18-in., 20-in., 24-in., or 30-in. motor or belt-driven, single-surface planer. Safety-head cylinder, three-knife type, fitted with good-grade steel knives. Knife-setting and jointing device complete with bar should be mounted on machine if possible

Saws
- *a*) Band saw, 20-in. to 36-in., motor drive. Upper and lower wheels to be completely guarded. Table to tilt to 45 deg.
- *b*) Combination, band saw, crosscut saw, ripsaw, and mortiser. Machine to be completely guarded
- *c*) Cut-off, pedestal or swing type to be fitted with 12-in. to 16-in. saw
- *d*) Filing machine, direct motor drive
- *e*) Jig, direct-motor or belt driven
- *f*) Portable band saw, 16 in. to 20 in. ball-bearing, motor-driven
- *g*) Saw bench, direct connected to motor, and to have both rip and crosscut saws. Rip and crosscut gauges also to be provided
- *h*) Universal saw bench, 14 in. to 16 in., motor driven
- *j*) Variety saw bench, motor driven, tilting table, with universal sliding table. The arbor is to be fitted for a dado head, and the table is to be slotted accordingly, The saw is to be equipped with ripping fence and miter cut-off gauges

Sander
- *a*) Belt, direct-motor-drive
- *b*) Disk, motor or belt-driven
- *c*) Oscillating-spindle, motor-driven
- *d*) Portable, hand-plane type, direct motor drive
- *e*) Vertical-spindle and disk sander

Shaper
- *a*) Motor drive, single or double spindle. Table to be equipped with removable center plate
- *b*) Portable shaper or router with a suitable selection of cutters

Tenoner — single end, with coping heads and cut-off saw

Vises — rapid-acting or solid-nut type woodworking-bench vises, 7-in. to 10-in. face

Wood Trimmers — complete with all gauges and taper pins. Base of trimmer to be slotted and laid out for degree settings (for patternmaking class)

Woodworking—Small Tools

Awls — brad, assorted sizes

Bevels
- *a*) Protractor
- *b*) Sliding T, 8 in.

Bits
- *a*) Auger, 3/16 in. to 1 in. inclusive, by 16ths
- *b*) Auger, 3/16 in. to ½ in. inclusive, by 16ths
- *c*) Braces, ratchet-type, 8 in., 10 in., 12 in., or 14 in. sweep
- *d*) Countersink, for wood, rose pattern, ½ in. and ⅝ in.
- *e*) Dowel, square shank, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
- *f*) Expansive, ⅞ in. to 1½ in.
- *g*) Expansive, ⅞ in. to 3 in.
- *h*) Forstner, square shank, ¼ in. to ½ in. inclusive, by 16ths
- *j*) Screw driver, square shank, ¼ in., 5/16 in., ⅜ in.
- *k*) Twist drill for wood, square shank, 1/16 in. to ⅜ in. inclusive, by 16ths
- *l*) Twist drill, straight shank, 1/16 in. to ⅜ in., inclusive, by 32nds

Blowtorch

Brooms

Brushes
- *a*) Bench duster, 10 in.
- *b*) Floor
- *c*) Glue, round, 1½ in. and ¾ in.
- *d*) Glue, round, 1½ in.
- *e*) Marking, camel's-hair, No. 1 and No. 2
- *f*) Varnish, flowing, 2 in. and 2½ in.
- *g*) Varnish, flat, ½ in., ¾ in., and 1 in.

Burnishers — oval or round

Can Opener

Carving Tools
- *a*) Sets containing 6 tools
- *b*) Sets containing 12 tools

Chisels
- *a*) Cold, machinists', ⅜ in. and ½ in.
- *b*) Mortising chisel and bits, ¼ in. to ⅝ in. by 16ths
- *c*) Socket-firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1½ in.
- *d*) Socket-firmer, plain edge, ½ in., ¾ in., and 1 in.
- *e*) Tanged-firmer, bevel edge, ⅛ in., ¼ in., ½ in., ¾ in., 1 in., and 1¼ in.

Clamps
- *a*) Bar, 24 in., 36 in., 48 in., and 60 in.
- *b*) Hand-screw, 4 in., 5 in., 6 in., 7 in., 8 in., 10 in., 12 in., and 14 in.
- *c*) Malleable-iron C, 4 in., 6 in., and 8 in.

Dividers — wing, 6 in. and 10 in.

Dowel Plate — 6 in. long

Doweling Jigs — with bushings

Drawknives — 7 in.

Drill
- *a*) Automatic hand, with 8 drill points
- *b*) Chuck, 0 to ⅜ in.
- *c*) Hand, 0 to ⅜ in., for round-shank drills
- *d*) Star, for concrete, ½ in. and ¾ in.

Files
- *a*) Auger bit, assorted, 6 in.
- *b*) Cabinet, 8 in. and 10 in.
- *c*) Card and brush
- *d*) Flat, wood, 10 in.
- *e*) Mill, bastard cut, 10 in.
- *f*) Round, bastard cut, 12 in.
- *g*) Taper, slim, 5½ in. and 7 in.

First-Aid Cabinet and Supplies

Gauges
- *a*) Bit, adjustable
- *b*) Jointer
- *c*) Marking, metal or hardwood
- *d*) Mortise, metal or hardwood
- *e*) Panel

Glass Cutter

(Continued on page 10A)

TRIED—TESTED and APPROVED IN THOUSANDS OF MODERN SCHOOL SHOPS

•*This* •*year*

THEY'RE *ORDERING* KEYSTONE PURE HIDE GLUE

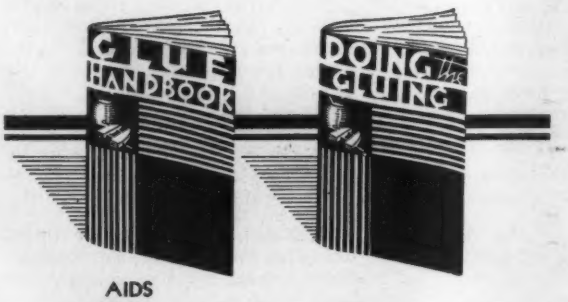
. . . . Why do instructors who use this *pure hide* glue find it ideal in every respect for School-shop use? The answers are both simple snd convincing:

ECONOMY—More square inches well-glued per pound of glue solution used.

DURABILITY—Keystone answers every requirement for strength, as proved by thousands of industrial shop tests under actual shop conditions.

EASY TO USE—The workability of this famous *pure hide* glue is famous in shops wherever used.

MANY INDUSTRIAL ARTS AND VOCATIONAL INSTRUCTORS ARE NOW EITHER SPECIFYING KEYSTONE ***PURE HIDE*** GLUES ON THEIR REQUISITIONS, OR ARE ORDERING NOW FOR IMMEDIATE OR FUTURE DELIVERY.



AIDS TO INSTRUCTION . . . .

All Instructors who have not yet received either one or both of the above publications are invited to take advantage of the limited supply remaining at once.

●

KEYSTONE GLUE COMPANY

Manufacturs of Pure Hide Glue Exclusively

WILLIAMSPORT PENNA.

(Continued from page 8A)

Gouges
- *a*) Tanged-firmer, outside ground, handled, ⅛ in., ¼ in., ½ in., ¾ in., 1 in.
- *b*) Tanged-firmer, inside ground, handled, ⅛ in., ¼ in., ½ in., ¾ in., 1 in.
- *c*) Spoon, ½ in., ¾ in., and 1 in.

Hammers — claw, bell-faced, 10-oz., 12-oz., 13-oz., 16-oz.
Hatchet — bench, 4 in. cut
Jars — earthenware, 1-qt. capacity
Knives
- *a*) Jointer, to fit power machine
- *b*) Planer, to fit power machine
- *c*) Sloyd, 3 in. blade

Levels
- *a*) Wood, 24 in.
- *b*) Machinists', 12 in.

Mallets — hickory, 3 in. by 5 in. head
Nail Sets — 1/16 in. and 3/32 in. points
Oilers — bench, 1/3-pt. coppered, best grade
Oilstones
- *a*) 1 in. x 2 in. x 8 in. in iron box
- *b*) Gouge slip, medium, 4½ in. x 2⅛ in. x ⅝ in. x 5/16 in.
- *c*) Gouge slip, fine, 3 in. x 2 in. x ⅜ in. x ⅛ in.

Pincers — 6 in. carpenters'
Pinch Dogs — ¾ in., 1 in., and 1¼ in.
Planes
- *a*) Block, adjustable, 6 in. long, 1⅝ in. cutter
- *b*) Circular
- *c*) Combination, adjustable
- *d*) Core box
- *e*) Duplex, fillister and rabbet
- *f*) Fore, ⅛ in., 2⅜ in. cutter
- *g*) Irons, double
- *h*) Jack, 14 in., 2 in. cutter
- *j*) Jointer, 24 in.
- *k*) Round, wood, 1¾ in.
- *l*) Router
- *m*) Smooth, 9 in., 1¾ in. or 2 in. cutter

Pliers
- *a*) Round-nose, 5 in.
- *b*) Side-cutting, 6 in.

Putty Knives
Rasps — half round, wood, 10 in.
Rules
- *a*) Board
- *b*) 1 ft. or 2 ft. graduated by 8ths and 16ths
- *c*) Shrink, ⅛ in., 3/16 in.

Saws
- *a*) Back, 12 in., 14-point
- *b*) Band, ¼ in., ½ in., ¾ in., to fit power machine
- *c*) Compass, 10 in.
- *d*) Coping, frames
- *e*) Coping, blades
- *f*) Crosscut, 9-tooth, 22 in. long
- *g*) Crosscut, circular for power machine
- *h*) Dado, ⅛ in. to 1 1/16 in. to fit power-saw arbor
- *j*) Hack, frames, 8 in. or adjustable
- *k*) Hack, blades, 8 in.
- *l*) Keyhole, 10 in., 10-point
- *m*) Rip, 7-point, 22 in. long
- *n*) Rip, circular for power machine
- *o*) Set, 10 points per inch and finer
- *p*) Set, 10 points per inch and coarser
- *q*) Turning frame, 14 in.
- *r*) Turning blades, 3/16 in. x 12 in., 10-tooth
- *s*) Miter-box, 24 in. x 4 in. saw, 7 in. capacity at miter

Scrapers
- *a*) Cabinet
- *b*) Glue, triangular
- *c*) Veneer, blade 2¾ in. long, handle 11 in. long

Screw Drivers
- *a*) Cabinetmakers', 4 in., 6 in., and 8 in.
- *b*) Quick-return, spiral ratchet

Shoot Board — and plane
Snips — tinners', forged steel, 2½ in. cut
Spokeshaves — adjustable, raised handle, 10 in. long
Squares
- *a*) Combination, 12 in.
- *b*) Try-, iron handle, 8 in.
- *c*) Framing, 2 ft.

Steel Figures — hand cut, ⅛ in.
Tapeline — 50 ft. steel
Trammel Points — adjustable metal frame, steel points
Turning Tools (for 12 lathes)
- *a*) Calipers, 6 in. inside and outside
- *b*) Calipers, 12 in. inside and outside
- *c*) Parting tools, ⅛ in.
- *d*) Round point, ¼ in., ½ in., ¾ in.
- *e*) Spear point, ¼ in., ½ in., ¾ in.
- *f*) Square point, ¼ in., ½ in., ¾ in.
- *g*) Turning chisels, ¼ in., ½ in., ¾ in.
- *h*) Turning gouges, ¼ in., ½ in., ¾ in.
- *j*) Turning skews, L.H., ¼ in., ½ in., ¾ in.
- *k*) Turning skews, R.H., ¼ in., ½ in.

Vise — 3 in. jaw anvil face
Wrenches
- *a*) Adjustable, 8 in., 10 in., and 12 in.
- *b*) Headless setscrew, ¼ in. to ⅝ in. by 16ths
- *c*) Pipe, 10 in. and 12 in.
- *d*) S-type or open-end type to fit ⅛ in. to 1 in. U.S.S. nuts

Woodworking—Materials and Supplies

Alcohol
Benzine
Brads — ⅜ in., ½ in., and ⅝ in. No. 20; ¾ in. and ⅞ in. No. 10; 1 in. No. 18; 1¼ in., and 1½ in. No. 16; 1¾ in. No. 15; 2 in. and 2½ in. No. 14
Carbon Paper — black
Colors — dry: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, Van Dyke brown, and vermilion
Colors — ground, in oil or japan: burnt sienna, burnt umber, cobalt blue, chrome yellow, drop black, lamp black, Prussian blue, raw umber, rose lake, Van Dyke brown, and vermilion
Decalcomania Transfers
Dowel Pins and Plates
Dowels: hardwood, 3-ft. lengths, ¼ in., 5/16 in., ⅜ in., ½ in., ¾ in.
Enamel
- *a*) Selected colors
- *b*) Undercoater

Fillers — paste: natural, golden oak, dark oak, and mahogany
Fillets — leather, ¼ in. and ½ in.
Glue
- *a*) Casein, hide, best grade cabinet
- *b*) Liquid

Hardware: Brackets, buttons, butts, casters, catches, chain, chest corners, chest trimmings, corner braces, corner irons, corner plates, desk fittings, door fittings, escutcheons, fasteners, handles, hangers, hinges, hasps, holders, hooks, knobs, latches, lamp fittings, lid supports, locks, pulls, smoking-stand outfits, springs, stops, supports
Hooks
- *a*) And eyes
- *b*) Cup
- *c*) Screw and
- *d*) Square screw

Lacquer — black, clear, cobalt blue, ivory, medium green, red, thinner, white and yellow
Lumber — Ash, balsa, bass, birch, cherry, cypress, locust, mahogany, maple, oak, poplar, red cedar, red gum, redwood, sap gum, yellow pine, walnut, white pine
In ordering pine, mill-run kiln-dried will be found suitable for carpentry, while short, select, kiln-dried 4 in. and wider or No. 1 shop common, kiln-dried will be required for cabinetmaking and patternmaking
Hardwood, for furniture, should be specified first and second grade, kiln-dried, standard widths and lengths, or short lengths
Moldings
Nails
- *a*) Common, 6d, 8d, and 10d
- *b*) Flat-head, ½ in. No. 20, ¾ in. No. 19, 1 in. No. 18, 1¼ in. and 1½ in. No. 16, and 2 in. No. 14
- *c*) Finishing, 4d, 6d, and 8d

Oil
- *a*) Linseed, boiled
- *b*) Linseed, raw
- *c*) Machine
- *d*) Rubbing

Overlay Carvings
Panel or Plywood — 3-ply, 5-ply, and 7-ply
Pattern Letters
Pins — escutcheon
Pumice Stone — No. 0
Rapping Plates
Rottenstone
Sandpaper — Garnet, No. 1, ½, 0, 2/0, 3/0, 4/0, and 6/0, wet or dry finishing
Garnet paper can also be obtained in rolls of 50 yds. each, and in widths 3 in. and up
Screw Eyes
Screws
- *a*) Flat-head, brass, No. 3 x ⅜ in., No. 4 x ½ in., No. 5 x ⅝ in., No. 5 x ¾ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1¼ in., No. 10 x 1½ in., No. 12 x 1¼ in., No. 12 x 1¾ in., No. 10 x 2 in.
- *b*) Flat-head, bright, No. 3 x ½ in., No. 4 x ½ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1 in., No. 10 x 1¼ in., No. 8 x 1¼ in., No. 14 x 1¼ in., No. 10 x 1½ in., No. 12 x 1½ in., No. 10 x 1¾ in., No. 12 x 1¾ in., No. 10 x 2 in., No. 12 x 2 in., No. 14 x 2 in., No. 12 x 2¼ in., No. 14 x 2¼ in., No. 14 x 2½ in.
- *c*) Oval-head, brass, No. 5 x ¾ in., and No. 10 x 1¼ in.
- *d*) Round-head, blued, No. 3 x ⅜ in., No. 3 x ½ in., No. 5 x ¾ in., No. 6 x ¾ in., No. 8 x 1 in., No. 10 x 1¼ in., No. 10 x 1½ in., No. 12 x 1½ in.
- *e*) Round-head, brass, No. 2 x ⅜ in., No. 3 x ⅜ in., No. 4 x ½ in., No. 3 x ⅝ in., No. 5 x ¾ in.

Shellac
- *a*) Orange, cut 4 lb. to the gal.
- *b*) Sticks, assorted colors
- *c*) White, cut 4 lb. to the gal.

Note: Shellac should be kept in glass or earthenware containers
Stains — oil, spirit or water: Fumed oak, dark oak, golden oak, light oak, mahogany, and walnut
Steel Wool — No. 0 and No. 00
Turpentine
Twine
Varnish — coach, flat, remover, spar, and rubbing
Waste — cotton, white
Wax — bees and finishing
White Lead

VIEW OF SHOP STUDIO OF WILLIAM DIXON SCHOOL OF METAL ARTS. SESSIONS AVAILABLE TO TEACHERS IN LATE AFTERNOONS, EVENINGS, AND SATURDAY MORNINGS. ALSO SUMMER SESSIONS. MODERATE RATES.
(A 30-HOUR ALERTNESS CREDIT TOWARDS SALARY INCREMENT IS ALLOWED BY THE NEW YORK CITY BOARD OF EDUCATION FOR WORK AT THIS SCHOOL.)

A MODEL SCHOOL FOR TEACHER TRAINING IN ART METAL, JEWELRY, SILVERSMITHING AND LAPIDARY

QUALIFY yourself to teach the ancient art of the jeweler and the silversmith—a popular industrial arts subject that is yearly winning new educational recognition and edoption in the curricula of school systems throughout the country.

The William Dixon School of Metal Arts is particularly adapted to teacher training. It has been sponsored by William Dixon Incorporated for the purpose of making it a model of completeness in tooling and equipment, also a leader in the calibre of instruction afforded.

Here may be obtained individual instruction, at moderate rates, for teachers desiring to add this subject to others for which they are qualified, or those expecting to direct summer camp classes. Also provided is special or advanced instruction for those already teaching the art.

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110 Fulton Street, Cor. Dutch Street New York City

WILLIAM DIXON SCHOOL OF METAL ARTS

(Continued from page 70)

Electrical conductors try, to a certain extent, to prevent the current from passing through them. This property is termed the resistance of the conductor. This resistance can be measured. The unit of resistance is the ohm.

There is a mathematical relation between the resistance, the voltage, and the amperage of a circuit. This relation is called Ohm's law. It was discovered by George Simon Ohm. According to Ohm's law, to find the resistance, the voltage is divided by the amperage. To find the amperage the voltage is divided by the resistance. To find the voltage, multiply the amperage by the resistance.

Example. A circuit having a resistance of 5 ohms is under a pressure of 110 volts. How much current will flow?

Answer. 110 divided by 5 equal 22 amperes.

Example. If the resistance of a circuit is 10 ohms, what voltage is necessary to cause a flow 20 amperes?

Answer. 20 times 10 equals 200 volts.

Method of Teaching. Oral explanation, demonstration.

IX. The Electric Circuit

Problems

1. Name the four parts of a circuit.
2. Draw symbols of the following electrical appliances: battery cell, resistance, push button, bell, and cut-out.
3. Name five electrical units, and give a definition of each.
4. What is a helix?
5. Name five uses of electricity in your home.
6. Name ten tools used by the electrician, and tell how and where they are used.
7. Write the equation for Ohm's law.
8. A circuit having a resistance of 10 ohms is under a pressure of 110 volts. How much current will flow?
9. If the resistance of a circuit is 20 ohms, what voltage is necessary to cause a flow of 20 amperes?
10. On a 110-volt circuit what resistance is necessary to obtain a flow of 15 amperes?

X. Conductance

1. Good conductors: silver, copper, aluminum.
2. Poor conductors: iron, carbon, German silver, nichrome.
3. Insulators: rubber, cotton, silk, varnish, glass, porcelain, paper, slate, wood.

Method of Teaching. Demonstrate with conductivity tester.

XI. Raw Material

Sources of: Copper, aluminum, iron, carbon, German silver, nichrome, rubber, cotton, silk, varnish, glass, porcelain, paper, slate, wood.

Method of Teaching. Oral explanation, blackboard illustration, use of samples.

Proposed Project. Private house bell circuit, teacher to furnish the wiring diagram.

XII. Raw Material

Preparation, Transportation, Manufacture, Cost, Geographical Aspects. Copper, aluminum, iron, carbon, German silver, nichrome, rubber, cotton, silk, varnish, glass, porcelain, paper, slate, wood.

Method of Teaching. Oral explanation, blackboard illustration, use of samples, stereopticon, motion pictures.

XIII. Early Electrical Discoveries

Many electrical discoveries were made quite early in history. When amber is rubbed with wool, it attracts pieces of pith or paper, due to a charge of electricity. This effect of electricity was discovered in ancient Greece.

The *magnet* was discovered in 300 B.C. in the ancient city of Magnesia, in Asia Minor, and it is from this city that the magnet gets its name.

The *compass.* Natural magnets found their first use in the compass. They were called lodestones. The word *lodestone*

(Continued on page 12A)

(Continued from page 11A)

means leading stone. The natural magnet was called a lodestone because it has the power through its polarity to point always toward the north.

The word *electric* was first used in a book published in the year 1600 by Sir William Gilbert, physician to the Queen of England. It springs from the word *elektron,* which is the Greek word for amber.

The first *condenser,* which was known as a Leyden jar, was discovered accidentally at the University of Leyden, in Holland, by some students who were attempting to put electricity in a bottle. This discovery was made in the year 1745.

The *lightning rod* was discovered by Benjamin Franklin in the year 1752. With the aid of a copper key, a kite string and a Leyden jar, he collected electricity from the clouds, thus proving that lightning and electricity are the same. From the knowledge gained by this experiment he invented the lightning rod.

Method of Teaching. Oral explanation, use of electrical questionnaire demonstration.

XIV. The Great Electrical Experimenters

In the year 1799, Allesandro Volta discovered current electricity and made the first electric battery. Volta's experiment, by providing a means of producing current electricity, opened up to science a great untouched field of investigation. This led to the discovery by Hans Christian Oersted, 1819, that a magnetic needle could be influenced by a wire carrying a current of electricity, and resulted in the invention of the electromagnet by Joseph Henry.

The First Telegraph. When Joseph Henry learned that an electromagnet would attract a small piece of iron with a sharp click, the idea of the telegraph was born.

On January 6, 1838, Samuel F. B. Morse first demonstrated to the general public his electric telegraph. Messages were sent over three miles of wire stretched around the walls of the Speedwell Iron Works, Morristown, N. J.

The First Generator. The electromagnet also led to the discovery that electricity could be produced with magnetism. Michael Farady, who made this discovery, is credited with the invention of the first generator in 1839.

Method of Teaching. Oral explanation, use of electrical questionnaire, demonstration.

XV. Modern Electrical Inventions

The First Telephone. Alexander Graham Bell discovered the principle of the telephone on June 2, 1875. His continued experiments, based on his discovery, resulted in an instrument that on March 10, 1876, really "talked" to the extent of transmitting a complete sentence.

The First Power Plant. In 1879, Thomas A. Edison invented the first incandescent lamp, and needed an improved form of constant voltage generator to furnish the current. Accordingly, he designed and built a power plant with generators, regulators, meters, and other parts of a complete electric system.

Radio, which is probably the greatest electrical development of modern times, was made possible by the discovery of radio waves by Hertz. Many other men, however, had a part in the development. Marconi erected the first transmitting and receiving stations, Tesla invented the original sending coils, Edison, Fleming and DeForest developed the radio tube, and Armstrong invented the modern sending and receiving circuits.

Method of Teaching. Oral explanation.

XVI. How to Read the Watt-Hour Meter

1. Read from right to left.

2. Read the right-hand dial. Note the direction of notation. Put down the figure that the hand has just passed. If the hand is on the figure, put down the figure.

3. Read the next dial (going to the left). Note that the direction of notation reverses. Read the figure that the hand has just passed. It is the smallest figure of the two between which the pointer stands.

4. Read the next dial (going always to the left). Note that the rotation reverses. Note that each dial to the left makes one-tenth revolution, while the dial on the right makes one revolution.

Method of Teaching. Blackboard illustration, demonstration with model.

XVII. Circuit Connections

1. Batteries in series.
2. Bells in series.
3. Lamps in series.
4. Batteries in parallel.
5. Buttons in parallel.
6. Bells in parallel.
7. Lamps in parallel.
8. Circuit wires.
9. Source wires.

Method of Teaching. Blackboard illustration, demonstration with model.

Proposed Projects. Connect 3 buttons to ring three bells, 3-wire return-call circuit, day and night circuit.

XVIII. Questions

1. Name three good conductors in the order of their conductivity.
2. Name three poor conductors and tell what they are used for.
3. Name three insulators.
4. What material is the best conductor of electricity?
5. Why is copper used for making electric wires?
6. Name five states where copper is mined.
7. What other material is used to make electric wires?
8. Where is the South American copper used in this country smelted?
9. How is copper prepared for commerce?
10. From what year do we date the beginning of the electrical industry?
11. Where does the word *electricity* come from?
12. Who invented the first generator?
13. Who installed the first power house in this country?
14. Give the dates of three great electrical inventions.
15. In "trouble shooting," give the order in which you would test a circuit.
16. How do the hands of a meter dial turn?
17. How do you decide which number is to be read?

XIX. How Electric Current is Generated

Chemical Generators

1. Wet cells — container, glass; poles, carbon and zinc; solution, sal ammoniac and water; action, sal ammoniac eats zinc; depolarizer, manganese dioxide.

2. Dry cells — container, zinc; poles, carbon and zinc; solution, sal ammoniac and water; action, sal ammoniac eats zinc; depolarizer, manganese dioxide.

3. Storage cells — container, rubber; plates, sponge lead and lead peroxide; separators, wood; solution, sulphuric acid and water; action, sulphuric acid changes plates to lead sulphate.

Magnetic Generators

1. Dynamos — fields made of electromagnets.

2. Magnetos — fields made of permanent magnets.

Heat Generators. Thermocouples.

Method of Teaching. Demonstration with models.

XX. Magnets and Magnetism

1. Natural magnets — lodestones.
2. Artificial magnets — bar, solenoid, horseshoe, ring, ironclad.
4. The three important properties of a magnet — polarity, attraction and repulsion, magnetic induction.
5. Rules of polarity — like poles repel; unlike poles attract.
6. The magnetic field.
7. Electricity makes magnetism.
8. Magnetism makes electricity.

(Continued on page 16A)

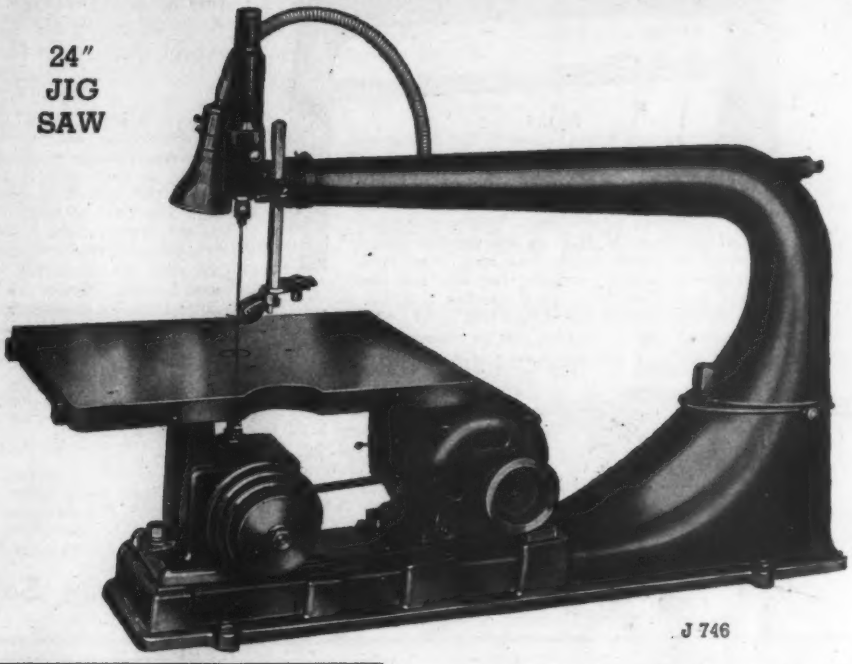
ADVERTISING PAGES REMOVED

DRIVER POWER TOOLS

are Dependable, Accurate, Easy To Operate

This improved Driver jig saw has many outstanding features. For convenience in sabre sawing, sanding and filing and for use with the Driver high speed router, the arm may be swung to the right or left. Two convenient electrical outlets are provided with the jig saw. One is located on the arm and feeds the flexo lamp, which is standard equipment and high speed router motor. The other is mounted on rear base and carries feed wire for arm outlet and motor. The distance upper vise to table is 4½". Table 16" x 12½". Table tilts to 45°, has graduated quadrant. Table may be tilted to 5° back and front. Speeds 1750-1295-926-644 R.P.M. Fabric boot on lower guide prevents dirt or abrasive dust from entering bearings. Height over all 2[illegible]½". Length 33".

24" JIG SAW



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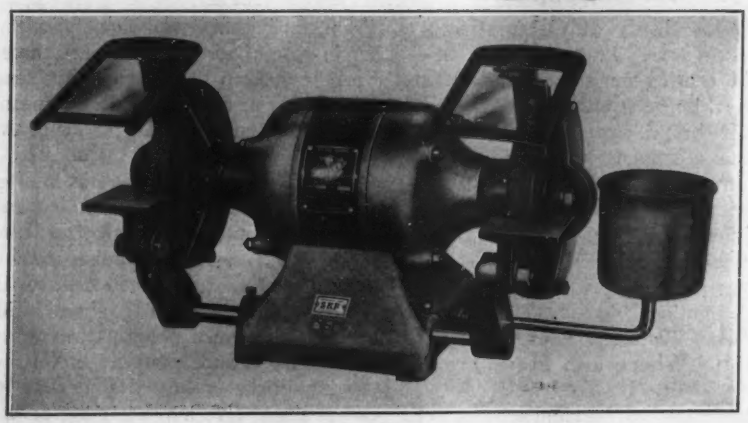


½ H.P. HEAVY DUTY MOTOR GRINDER

This new heavy duty motor grinder has outstanding features which assure utmost in utility and permanent performance. Motor is ½ H.P. capacitor type with plenty of overload capacity to handle all kinds of work in constant use. It has a high grade switch mounted in base, operating speed is 3500 R.P.M. Equipped with large grease-sealed SKF ball bearings. Wheels are 7" in diameter, 1" wide, carefully balanced. Guards provide full protection, their design being in accordance with latest safety code requirements. Non-shatterable glass shields and cooling cup regular equipment. Shafts ⅝" diameter. Motor end bells are extended so that work may be more conveniently handled. Wheel guards and tool rests are fully adjustable.

Here is a genuine heavy duty, all purpose lathe. For woodworking, metal turning or spinning. The bed is 54" long, 4¾" high. Distance between center 37". Swing at gap 13½", rest of lathe 10". Has No. 2 Morse Taper centers. Hollow head spindle is ⅝" inside diameter. Diameter of spindle between bearings 1". Has SKF ball bearings.

Tail stock has set over for turning tapers. 18" Extension bed available for extra long turnings.

GAP BED LATHE

L 751

For complete information on Driver Power Tools and accessories send for free forty page 1936 Catalog. Write Dept. 826.

WALKER-TURNER CO. INC.

Plainfield New Jersey

"MONARCH" Woodworking Machines

Fig.1115

The Four Speed Head Stock Lathe is an efficient, compact and complete machine especially adaptable for manual training requirements. It has head stock fully enclosed, motor of ½ H.P. at low speed developing more power at higher speeds, four speed lever control and magnetic switch providing for overload and under-voltage protection, head stock spindles threaded at both ends for face plates, tail stock of box design and easily adjustable tool rest that swings to any angle. Specifications on request.

6" and 8" BENCH JOINTERS

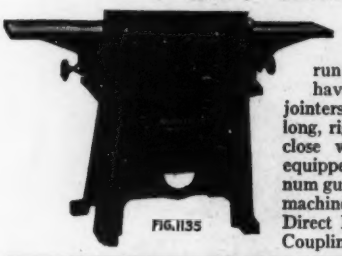


FIG.1135

These Jointers are made in six-inch and eight-inch sizes, with safety round heads that run in high grade ball bearings. They have all of the adjustments of large jointers and are built with exceptionally long, rigid tables and are guaranteed for close work. Both sizes are regularly equipped with rabbeting arms and aluminum guards of the swinging type. Either machine is arranged for Belt Drive or Direct Motor Drive by means of flexible Coupling or Shaftless Motor.

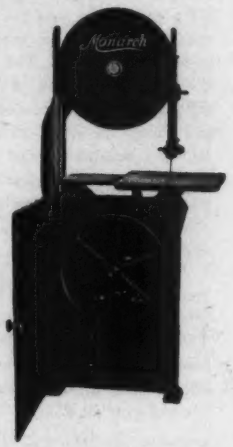
Particularly Adapted for Manual Training Schools

Illustrated here are but a few of the complete Monarch line of Woodworking Machines. Built to rigid specifications of materials of proved quality, they answer the school shop's need for dependable equipment.

No. 72 — 20" BAND SAW

Here is a band saw of the latest approved designs, built to meet the most rigid requirements of safety regulations. Every moving part is fully guarded, except the portion of saw blade in the cut. The UPPER WHEEL is mounted on ball bearings; the LOWER WHEEL is mounted directly on the motor shaft, allowing the maximum of power for useful work. Motors of ¼, ¾ and 1 H.P. may be used and furnished for the following electric currents:

115 or 230-volt direct current, 850 R.P.M.
220, 440-volt, 2 and 3-phase, 60-cycle, 875 R.P.M.
550-volt, 3-phase, 60-cycle, 875 R.P.M.
550-volt, 3-phase, 25-cycle, 715 R.P.M.
220, 440- volt, 2 and 3-phase, 25-cycle, 715 R.P.M.
220, 440, 550-volt, 3-phase, 50-cycle, 970 R.P.M.
110, 220-volt, single-phase, 850 R.P.M.



Details and specifications on any other Monarch Woodworking machine in which you are intersted will be furnished on request. Write.

American Saw Mill Machinery Co.
74 Main St., Hackettstown, N. J.

(Continued from page 12A)

Method of Teaching. Demonstration with model.

Proposed Projects. Electromagnet, needle compass.

XXI. Occupational Information

Activities. Outside electricians: cable splicers, linemen; inside electricians: wiremen, fixture hangers, trouble shooters, armature winders, motor repairmen, elevator repairmen, switchboard operators, radio service men, electricians' helpers, apprentices, maintenance men — ship electricians, power-house electricians, building electricians, newspaper-press electricians.

Skill required — very high.

Wages per Day. Union scale: mechanic, $13.20*; helper, $8.50. Non-union scale: mechanic, $6.00; helper, $4.50.

Is the worker likely to be replaced? No. Is the occupation overcrowded? No. What is the trend and chance for advancement? Very good. Effect on health.

Method of Teaching. Oral explanation; photographs, stereopticon views; motion pictures.

*Note: These figures taken from the last agreement made between the Employers Association and Local No. 3 of New York City.

XXII. Study of Occupation

Self-analysis. Physical condition — sight, hearing, muscular co-ordination, nerves, lungs, strength; mental condition — bright, slow, alert; social condition — contacts; financial condition — advantages, schools; industry — adaptability, willingness, earnestness, indifference, carelessness, laziness; character — dependability, convictions; personal qualities — moral, social, emotional.

Method of Teaching. Oral explanation.

XXIII. Where and How Trade May Be Learned

Apprenticeship — union system, non-union system; schools — day schools, evening schools; educational help — drawing, science, mathematics; time required.

Method of Teaching. Oral explanation.

XXIV. Safety

Hand tools—cutting tools, knives, saws, chisels, etc.; heated tools — soldering irons, stoves, etc.; machine tools and their care; climbing equipment — ropes, ladders, etc.; the State Industrial Code; the Electrical Code — City, National.

Method of Teaching. Oral explanation, demonstration.

XXV. First Aid to the Injured

The three things you should remember in case of serious injury are these: Keep cool, keep the crowd away, send for a doctor or ambulance. In the meantime, do what you can to help the victim.

Shocks. Present in all serious injuries and greatly increased by bleeding and pain. Its symptoms are pale face, cold clammy skin, rapid weak pulse, shallow breathing. Lay patient on back with head low, loosen clothing about head, neck, and abdomen. Keep patient warm with blankets and hot-water bottles, or use hot bricks or heated stones. If he can swallow, give him hot milk, or hot water, and a half teaspoonful of aromatic spirits of ammonia in water. Never pour liquid down the throat of an unconscious person.

Hemorrhage. Bleeding can usually be stopped by placing small pad of gauze over the wound, and wrapping with tight bandage. If this does not stop the bleeding, elevate limb, and press with thumb on main blood vessel between wound and heart. The points of pressure are: just in front of bleeding from temple, inner side of arm below armpit about where inside seam of shirt comes, inner side of thigh near groin,

(Continued on page 18A)

Stanley Tools

Educational Department New Britain, Conn.

Manufacturers of

Hand Tools for

Woodworking and Farm Shops — The most complete line offered by one manufacturer. Ask for Catalogue No. 34.

Electrical Shops—Hammers, Bit Braces, Bit Extensions, Screw Drivers, etc. Ask for Catalogue No. 34.

Sheet Metal Shops—Hammers, Chisels, Punches, etc. Ask for Catalogue No. 34.

Automobile Shops—Body and Fender Tools, Hammers, Chisels, Punches, Pliers, Files, Screw Drivers, etc. Ask for Catalogue No. 26A.

Machine Shops—Hammers, Rules, Chisels, Punches, Levels, etc. Ask for Catalogue No. 34.

Forge Shops — Anvil Tools, Tongs, Hammers, etc. Ask for Catalogue No. 34.

Instructors of the shop subjects listed above should have our catalogue when specifying equipment. The catalogues are illustrated below—send for them.

The hard and accelerated usage that tools are subject to in the school shop demands quality tools. For more than three-quarters of a century Stanley Tools have been made to the sound policy of Quality First. Specify Stanley Tools for the utmost in economy and service and avoid substitutions.

Send for these Special School Catalogues

Catalogue No. 26A-Automotive Tools

Shows a complete line of hand tools, with the exception of wrenches, and a complete line of Body and Fender Repair Tools. It describes chrome vanadium alloy steel Chisels and Punches, molybdenum alloy steel Pliers, new Screw Drivers with Stanloid handles—the toughest non-metallic substance known — and many other tools of particular value to the school shop.

Catalogue No. 34 Wood and Metal Working Tools

Illustrates and describes over 1500 Stanley Woodworking and Metal working tools—192 pages. Because of its completeness and profuse illustrations, you will find this book helpful in making up your tool specifications.

"Stanley Equipment is Standard Equipment"

Stanley Tools, Educational Dept. 106 Elm Street, New Britain, Conn.

ATKINS

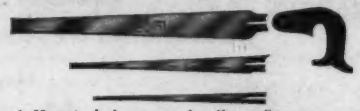
SILVER STEEL SAWS

No. 401 Ship Point—the best hand saw made. SILVER STEEL. Taper ground. Straight back. (No. 400 is skew back) Ship point in 26" length only. Regular pattern in 24" and 26" lengths.

No. 65 Ship Point for general use. SILVER STEEL. Taper ground. Straight back. (No. 53 is skew back) Ship point in 26" length only. Regular pattern in 20", 22", 24" and 26" lengths.

No. 10 Hacksaw Frame has non-breakable, hard rubber handle. Takes 8" to 12" blades.

"Blue End" Blades of SILVER STEEL. No others as good for economical cutting. (Also AAA blades of Tungsten Alloy steel but regular quality.)



No. 3 Nest includes 3-way handle, 14" compass, 12" keyhole and 16" tempered metal blade, all interchangeable.

No. 37 Dual Ground circular for wood working shops. Makes glue joints direct from saw. 5" to 20" diameters for all standard machines.

"AAA" Saw Guards recommendedde for all woodworking and school shops by state inspectors. Takes lumber up to 3". Lumber cannot kick backwards.

ATKINS SILVER STEEL Files for every use. Round, square, half-round and flat in all classifications. Tough and long wearing.

"THE FINEST ON EARTH"

Ask for Atkins TEXT BOOK and SAW SENSE—they're free.

E. C. ATKINS AND COMPANY

404 So. Illinois Street Indianapolis, Ind.

(Continued from page 16A)

and in the hollow place back of knee. If this fails, use torniquet. Twist gradually with stick until bleeding stops. Loosen every fifteen minutes to see whether bleeding has stopped.

Stretcher. Three persons are necessary to place an injured person on stretcher: one to lift the head and shoulder, another the hips, and a third the legs. The stretcher should be placed beside the patient and the helpers should kneel on his opposite side. They should then lift the patient first to their bended knees, and then lay him gently on the stretcher.

Electric shock, apparent drowning, gas or smoke asphyxiation. For all of these apply artificial respiration. In cases of electrical shock, quickly release victim from current, using a dry non-conductor (rubber gloves, several thicknesses of newspaper, dry clothing, wool or felt hat wrapped around hand, rope or board). Beware of using any metal or moist material. If possible, shut off current.

To apply artificial respiration, place the victim on his stomach, clear possible obstruction from mouth, beginning artificial respiration at once.

Method of Teaching. Oral explanation, demonstration.

XXVI. Questions for Final Test

1. Name the four parts of an electric circuit.
2. Draw symbols of the following electrical appliances: battery cell, resistance, push button, bell and cut-out.
3. Name five electrical units, and give a definition of each.
4. What is a helix?
5. What would happen if staples were placed on the corners of bell wire?
6. Name five uses of electricity in your home.
7. Name ten tools used by the electrician, and tell how and where they are used.
8. Write the equation for Ohm's law.
9. Name three good conductors in the order of their conductivity.
10. Name three poor conductors and tell what they are used for.
11. Name three insulators.
12. What material is the best conductor of electricity?
13. Why is copper used for making electric wires?
14. Name five states where copper is mined.
15. How is copper prepared for commerce?
16. From what year do we date the beginning of the electrical industry?
17. Where does the word *electricity* come from?
18. Who invented the first generator?
19. Who installed the first powerhouse in this country?
20. Give the dates of three great electrical inventions.

Related Information Content

This information content for a junior-high-school exploratory course in electricity was selected with the objective of presenting as much educational information as possible in 10- to 12-minute presentations extending over a period of 20 weeks. This information content should be demonstrated with sectioned parts of the material presented. Where this is not possible, it should be illustrated with blackboard sketches, photographs, stereopticon views, or motion pictures.

History of Electricity. Early electrical discoveries, important men in electrical development.

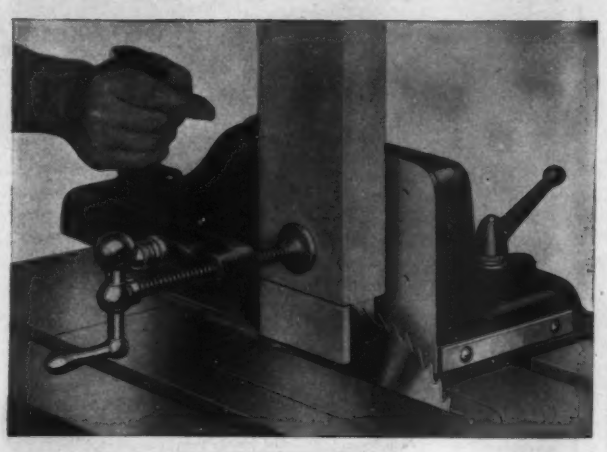
Nature of Electricity. The electron theory, static electricity, electricity in motion, a.c. current, d.c. current.

Sources of electricity: Dry cells, wet cells, storage batteries, magnetic generators.

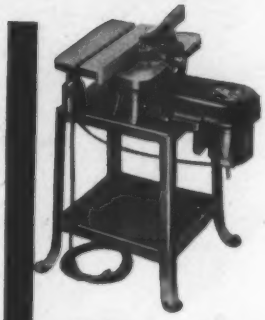
Conductors and Insulators: Electrical

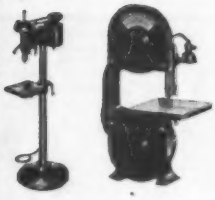
(Continued on page 20A)

NEW "DELTA" ATTACHMENT MAKES *TENONING SAFE..*



Now, thanks to this newly developed Delta attachment for Delta circular saws—anyone can do tenoning on the circular saw, swiftly, accurately and with utmost safety. Every possibility of risk is eliminated. The work is fed to the saw with one hand far removed from the revolving blade. Facilitates fast and accurate repetition work, such as the making of tenons, dado cuts on end grain, housings on sash and cabinet work. Ideal for home workshops, schools, light manufacturing work. Costs surprisingly little. Takes stock up to 2¾ in. thick, any width within capacity of saw, and will cut tenons up to 2¾ in. long on 8 in. saw, any width desired. For full details see 1936 Delta Catalog.





Delta Manufacturing Company is now the largest manufacturer in the world making this type of machinery exclusively.

New DELTA Shaper Unit

The Delta Shapers, although new additions to the Delta line, have been greeted enthusiastically by wood workers everywhere. Important basic features include: **1.** Extra Large Table permitting the handling of large work with ease; **2.** Interchangeable Spindles for ⅛" and ½" hole cutters for various types of work; **3.** Improved Completely Adjustable Fence for all varieties of straight work; starting pin for curved work of all kinds; **4.** Complete Guarding system; **5.** High Speed of 10,000 R. P. M. which with standard 3-lip Delta cutter gives over 30,000 cuts a minute, thus insuring smooth and finished work; **6.** Complete range of cabinet and sash cutters for all types of mill work.

COMPLETE LINE OF QUALITY TOOLS

"Quality" as applied to Delta Tools is more than an adjective. It is an actual fact recognized by tens of thousands of users of motor-driven tools all over the world. The Delta line includes Circular Saws, Jointers, Lathes, Scroll Saws, Band Saws, Routers, Shapers, Grinders and a complete assortment of attachments and accessories.

New 10-in. Circular Saw

Another new sensational Delta hit! Many unusual new features. Write for full details.

Write for 1936 Catalog

It shows the complete Delta line of motor-driven tools. Explains their economy and efficiency. Describes the careful practical guarding system. Proves that these tools are splendidly adapted for school shop use.

Mail coupon without delay. Enclose only 10 cents at same time for Book No. 2 of Practical Delta Projects, 32 pages of new and novel things to make, with numerous blue prints, working drawings, photographs and illustrations—and complete directions for new projects.

DELTA MANUFACTURING CO.
600-634 E. Vienna Ave.
(Dept. E236)
Milwaukee, Wis.

DELTA MANUFACTURING COMPANY,
600-634 E. Vienna Ave., Dept. E236
MILWAUKEE, WISCONSIN

I enclose 10c (stamps or coin), for which please send me one copy of Book No. 2 "Practical Delta Projects". Also place me on your mailing list to receive 1936 Delta catalog of quality motor-driven wood-working tools.

Name _____

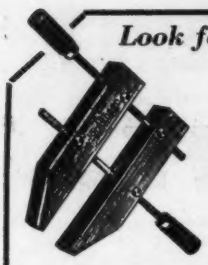
Address _____ Age _____

City _____

State _____

☐ Check here if you are a Delta user now.

Delta **QUALITY** *represents real* **ECONOMY**



Look for " TRADE MARK Jorgensen " REG U S PAT OFF on CLAMPS

It is not enough to specify "Jorgensen" when ordering. Look for the "Jorgensen" Mark and be sure that you get them. Standard throughout industry. Genuine Jorgensens never slip or stick; jaws never split or spring; handles never loosen nor spindle nuts jam. Look for the "Jorgensen." It guarantees lifetime service.

Jorgensen "HIGH-SPEED" Steel Bar Clamps come in six improved types with patented Multi-Disc Clutches that "zipp" to position—hold at any point on the bar. They cut tightening time to a fraction; have strength beyond any need.

"Pony" Clamps are designed, manufactured and guaranteed by us. Pony 500 Fittings are recommended for schools because they go on ordinary ¾" pipe to make clamps of any length—provide low-cost, light, strong clamps for work of any size. Equipped with Multi-Disc Clutches. Several types.

"Pony" Miniature Clamps have "a million uses" on both delicate and large work. Sold at toy prices, they are, strictly speaking, quality tools.

Write for New General Clamp Catalog, Just Out.

Quality Miniature Clamps — Made with best malleable iron frames cadmium plated. Steel screws with deep standard threads, freely turning swivels, loose pin handles. 7 sizes and shapes from 1" to 2½" cap.

Adjustable Clamp Co.
"The Clamp Folks"
424 N. Ashland Ave., CHICAGO

SIMONDS DADO SAWS

By combining outside saws with inside cutter, clean grooves may be cut in any direction of the wood any width from ⅛ to 4 inches wide. When writing state widest groove to be cut.

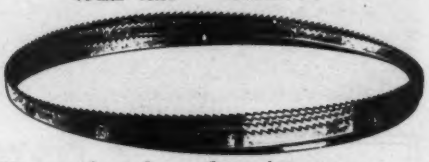
The Smooth Cutting
PLANER SAW

Cuts with or across the wood grain and leaves an edge smooth enough for glue joints. Saves time.

LIST PRICES (subject to discount)

6 inch $5.55	12 inch $11.20
8 inch 7.00	14 inch 13.40
10 inch 9.00	16 inch 15.80

Brown steel
BAND SAWS
any width or length.



Write for Saw Catalog

SIMONDS SAW AND STEEL CO.
Fitchburg, Mass.

(Continued from page 18A)

conductors, electrical insulators, insulated wire.

Magnetism: The permanent magnet, electromagnet, helix and solenoid, lifting magnet, earth as a magnet, compass.

How Electricity Causes Mechanical Action. The electric motor, doorbell, buzzer, relay, door opener, magneto switch, circuit breaker.

How Electricity Causes Heat and Light. Changing electricity to heat, electric heaters, electric arc furnace, the incandescent lamp.

How Electricity Causes Chemical Action. Electroplating, electrotyping, refining of metals, manipulation of hydrogen and oxygen, smelting aluminum.

Fuses. Use a fuse, construction, testing.

Bell Wiring. Bell circuits, annunciation circuits, apartment-house circuits, telephone circuits.

Light Wiring. Home wiring circuits.

Rectifiers. Principle of rectifier, battery chargers.

Transformers. Principle of transformers, uses of transformers.

Tools and Materials. Tools used in shop; insulators, conductors, wire.

Health and Safety. Safety rules, first aid, the industrial code, the electrical code.

Occupational Information

1. Name and description of occupation.
2. History of trade occupation.
3. Commercial and industrial aspects of trade or occupation.
4. World centers of the trade or occupation.
5. Sources of raw materials.
6. Preparation of raw materials.
7. Nature of electrical work.
8. Self-analysis.
9. Where and how the trade may be learned.

New Uses of Electricity. Talking pictures, neon tubes, photocells, electric welding, electric furnaces, electrolysis, radio, vacuum tubes, X-ray.

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(Continued on page 24A)

WALLACE MACHINES

Portable Low Cost High Speed

#26 WALLACE 6″ JOINTER, tables 30″ long overall, adjustable, steel fence 22″ long adjustable to 45° stop at 90°; automatic guard covering knives; circular cutterhead, rotating on heavy roller and ball bearings, fitted with three high speed steel knives; direct connected to 3600 R.P.M. ball bearing motor with 30 ampere 2-pole toggle switch, rubber covered cord and plug, knives set and jointed ready to operate with—

½ H.P. Motor, 110/220 v., 60 cycle, AC, 1-phase
1 H.P. Motor, 110/220 v., 60 cycle, AC, 1-phase
1 H.P. Motor, 220 v., 60 cycle, AC, 3-phase

#23 WALLACE OILSTONE GRINDER, adjustable table and tool holder to grind knives 8″ long; motor driving at 500 R.P.M. thru a worm and worm wheel in an oil bath; equipped with a floor stand; 1 cone shaped wheel; 1-4″x½ dry grinding wheel; 2-6″x2″ cup grinding wheels; one fine and one course; switch; rubber covered cord and plug, ready to operate with—

¼ H.P. Motor, 110 or 220 volts, 60 cyc. AC, 1-phase
¼ H.P. Motor, 220 volts, 60 cyc. AC, 3-phase

#18 WALLACE SHAPER, 16″ diameter cast iron table adjustable vertically; motor drive unit with ½″ diameter high carbon steel spindle integral with armature shaft rotating at 10,000 R.P.M. on heavy radial-thrust ball bearings, equipped with 2 grooved collars, spacers and wrench, 30 ampere 2-pole toggle switch, rubber covered cord and plug, ready to operate with—

½ H.P. Motor, 110 or 220 volts, DC or AC, 1-phase

#9 WALLACE MORTISER, 24″ long table raised and lowered by quick action handwheel; motor drive unit reciprocated on same steel rods by stirrup type foot pedal, 3600 R.P.M. motor with ½″ Almond or Jacobs chuck for bits; top bearing protected with slinger type oil seal; with 30 ampere 2-pole toggle switch, rubber covered cord and plug, three hollow chisels and bits—¼″, ⅜″ and ½″ square; ready to operate with—

½ H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 220 volts, 60 cycle, AC, 3-phase

#20 WALLACE UNIVERSAL SAW, 20″x20″ steel table to rip or crosscut 10″ wide; one crosscut fence sliding in rails milled on both sides of frame; motor drive unit raising, lowering and tilting in frame; rotating spindle at 5200 R.P.M. (no load speed) with 30 amp. 2-pole toggle switch, rubber covered cord and plug, one 8″ diameter blade cutting 2-½″ deep, ready to operate with—

½ H.P. Motor, 110 or 220 volts, DC or AC, 1-phase

W-2 WALLACE ELECTRIC GLUE POT, 2 quart capacity, with heavy cast aluminum body; pressed copper glue container; automatic temperature control; 650 watt metal sheathed heating element; 10 ft. asbestos heater cord, with plug separable at glue pot, ready to operate—

On 110 or 220 volts, AC or DC

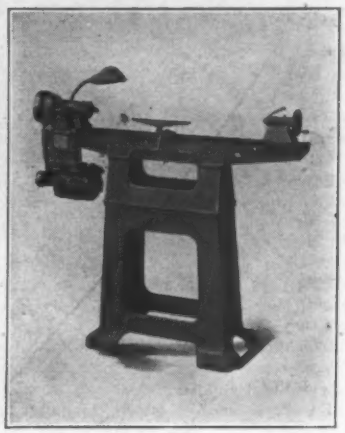
#66 WALLACE SINGLE SPEED LATHE, takes stock 36″ between centers; self-contained motor headstock with ⅝″ dia. high carbon steel spindle integral with armature shaft rotating at 1800 R.P.M. on heavy radial thrust ball bearing in front and bronze bearing in rear; equipped with base and legs; 6″ and 12″ tool rests, 3″ and 6″ face plates, 30 ampere 2-pole toggle switch, rubber covered cord and plug, ready to operate with—

½ H.P. Motor, 110 or 220 volts, 60 cycle, AC, 1-phase
½ H.P. Motor, 220 volts, 60 cycle, AC, 3-phase

J. D. WALLACE & COMPANY
140 S. California Avenue Chicago, Illinois

DESIGNED TO MEET SCHOOL NEEDS

No. 46 WALLACE MULTI-SPEED LATHE

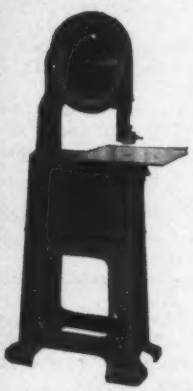


with cast iron bed taking stock 36″ between centers; headstock with 1-½″ solid spindle of high carbon steel, mounted on heavy tapered roller bearings; headstock adjustable at right angles to bed for large face plate turning; self-contained cradled motor driving spindle with 1″ flat belt giving 9 speeds from 550 R.P.M. to 2400 R.P.M., equipped with legs and base, 6″ and 12″ tool rests; 3″ and 6″ face plates, belt, adjustable electric light fixture, 30 amp. 2-pole toggle switch, rubber covered cord and plug, ready to operate with—

½ H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
½ H.P. Motor, 220 volts, 60 cycle, 3-phase

Extra equipment recommended: #4879 Floor stand tool rest holder. #4801 Aluminum face plate, 14″ diameter. #3948 Set of 4 lathe turning tools, sharpened at both ends with 8 shapes, including 2 rubber handles.

No. 16 WALLACE BAND SAW



with 19″x21″ steel table tilting to 45° on an accurately machined cradle; 16″ diameter pressed steel disc wheels faced with rubber ground to a true crowned periphery, rotating on heavy ball bearings; both wheels covered completely with removable guards; electric light built into upper front guard to light working area; upper wheel adjustable for various blade lengths, and tiltable to track blades; ball bearing guides above and below table; self-contained motor drive unit, driving wheels at 1200 R.P.M. thru steel and iron helical gears in oil bath; with 30 ampere 2-pole toggle switch, rubber covered cord and plug; one ½″ band saw blade cutting 16″ wide and 8″ thick, ready to operate with

½ H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 220 volts, 60 cycle, AC, 3-phase

Extra equipment recommended: Band saw blades—¼″, ⅜″, ½″ or ¾″ wide.

No. 8 WALLACE UNIVERSAL SAW

with 25″x25″ steel table to rip or cross cut 12″ wide; rip fence with micrometer adjustment, one right and one left hand cross cut fence. all fences sliding on rails milled in frame; automatic shutter saw guard; self-contained motor drive unit, raising, lowering and tilting in frame, leaving table in fixed position, rotating spindle at 5200 R.P.M. thru steel and iron helical gears in oil bath; with 30 ampere 2-pole toggle switch, rubber covered cord and plug; one 8″ diameter blade cutting 2¼″ deep, ready to operate with—

½ H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 220 volts, 60 cycle, AC, 3-phase
2 H.P. Motor, 220 volts, 60 cycle, AC, 3-phase

Extra equipment recommended: #2171 Extension tables for #8 Universal Saw, to rip 24″ wide and cross cut 18″ wide. 8″ dia. blades—cross cut, rip or comb. tooth. 8″ dia. hollow ground mitre blade. 7⅛″ dia. genuine Huther Dado Head cutting grooves up to ¼″ wide by 1/16ths. #2175 Adjustable electric light fixture with flexible arm, 18″ long, metal shade-reflector, cord and separable plug for connection to the switch box, and bracket for attaching the fixture to the machine.

No. 10 WALLACE 8″ JOINTER

with tables 40″ long overall, adjustable by large hand wheels; steel fence 22″ long, adjustable to 45° with stop at 90°; automatic bridge type guard covering knives; circular cutterhead rotating on heavy taper roller bearings, fitted with four high speed steel knives set askew in the head, and each clamped with 4 alloy steel bolts; direct connected to a 3600 R.P.M. ball bearing motor with 30 ampere 2-pole toggle switch; rubber covered cord and plug; knives set and jointed, ready to operate with—

½ H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 110/220 volts, 60 cycle, AC, 1-phase
1 H.P. Motor, 220 volts, 60 cycle, AC, 3-phase

Extra equipment recommended: Motor drive unit rotating cutterhead at 5000 R.P.M. thru steel and iron helical gears in oil bath, extra—#348 Cast iron stand for #10 Jointer. 4 Extra knives for #10 Jointer, 8″ long—#489 Knife Jointer—Adjustable electric light fixture with flexible arm, 18″ long, metal shade-reflector, cord and separable plug for connection to the switch box, and bracket for attaching the fixture to the machine.

Printshop Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Bellows
- *a*) Hand, small size
- *b*) Electric, blower type

Blackboard — permanent or portable

Bookcase — for reference books, catalogs, etc., sectional preferable

Brayer — 6 in. or 8 in., for proofing

Brushes
- *a*) Bench
- *b*) Benzine, No. 1, oval black
- *c*) Floor
- *d*) Padding, 1½ in. wide

Bulletin Board

Cabinets
- *a*) Galley, for double-column, wood or steel, four tiers (to be used with typesetting machines)
- *b*) Galley, for 8¾ in. by 13 in. galleys, wood or steel, four tiers
- *c*) Ink and roller, to accommodate platen-press rollers, wood or steel
- *d*) Matrix, for use with typesetting machines only
- *e*) Roller, cabinet or rack for cylinder rollers
- *f*) Supply, for leads, slugs, spaces, strip material, with top for lead cutter and mitering machine
- *g*) Type, school-type, each to accommodate two California cases, job cases, case slides, galley slide, and copy holder
- *h*) Type, complete with 24 full-size California job cases, with overhead lead-and-slug cases, wood
- *j*) Type, complete with 24 full-size California job cases, double work bank, wood or steel
- *k*) Wood or metal, for filing class records, instruction sheets, etc.

Cans
- *a*) Benzine, pint-size
- *b*) Benzine, 5-gal. size
- *c*) Kerosene, safety, 1-gal. size
- *d*) Waste can, fireproof, for rags

Cases
- *a*) Blank, full-size, to accommodate ¼-size cases
- *b*) Border, ¼-size, for ornamental borders
- *c*) Lead and slug, regular-size, to hold labor-saving fonts of leads and slugs
- *d*) Metal furniture, to hold labor-saving fonts
- *e*) Rule, ¼-size, for brass rule

Chairs — teacher's and tablet-arm

Chase Racks
- *a*) For platen presses
- *b*) For cylinder presses

Chases
- *a*) For each size of platen press
- *b*) For cylinder press

Composing Sticks — 6 in. x 2 in., 8 in. x 2 in., 12 in. x 2 in., and 18 x 2 in., adjustable

Cutter
- *a*) Lead and rule
- *b*) Paper, lever-type, 20 in., with pedestal. Should handle 20 in. x 26 in. sheet
- *c*) Paper, lever-type, 26 in. or 30 in.
- *d*) Paper, lever-type, 30 in., with divided back gauge
- *e*) 30 in. to 36 in. power cutter

Desk — teacher's, with drawer compartments

Drying Racks
- *a*) Combination drying rack and stock table for platen presses, 30 trays
- *b*) Trays, interlocking, for cylinder press

Folding Bones — for hand folding

Folding Machine — 20 in. x 26 in. size, 4-fold, two parallel and two right-angle folds, power

Furniture — iron, 2 x 4 to 10 x 15 picas

Galleys — Steel, 8¾ in. x 13 in., 6¼ in. x 23½ in., double column, and 12 in. x 18 in.

Gauge Pins — spring-tongue

Glue Pot — electric, 1-qt. size

Imposing Tables
- *a*) 12 in. x 18 in., with iron top, including reglets and furniture
- *b*) 24 in. x 36 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *c*) 36 in. x 48 in., with iron top, complete with galley slides, chase rack, reglets, and furniture
- *d*) 39 in. x 63 in., with iron top, complete drawers, letter boards, reglets, and furniture

Ink Fountains
- *a*) Short, for 8 x 12, 10 x 15, and 12 x 18 presses
- *b*) Long, for 10 x 15, and 12 x 18 presses

Knives
- *a*) Overlay, for make-ready
- *b*) Ink, 6 in. and 8 in.
- *c*) Ink, 8 in., square end

Leader Boxes

Leaders
- *a*) 6-pt., 8-pt., and 10-pt., fine dot
- *b*) 8-pt. and 10-pt. hyphen

Line Gauges
- *a*) Metal, brass, or steel
- *b*) Wood

Metal Furnace — for recasting and refining type metal, used only with typesetting machines

Mitering Machine

Numbering Machines
- *a*) For use on presses
- *b*) Hand machines

Ornaments
- *a*) Assorted floral and decorative designs
- *b*) Border, 6-pt. and 12-pt., decorative

Perforator
- *a*) 24 in., foot treadle
- *b*) 28 in., foot treadle

Planer
- *a*) Mallets, hickory or fiber
- *b*) Proof, maple, with felt bottom
- *c*) Type, maple, with leather top

Presses
- *a*) Cylinder, two-revolution, four-roller, 25 x 38, complete with variable-speed motor, cast rollers, etc.
- *b*) Platen, 8 x 12, with foot treadle, counter, flywheel guard, platen guard, brake, and set of cast rollers (motor and treadle combination if desired)
- *c*) Platen, 10 x 15, complete with variable-speed motor, counter, flywheel guard, brake, and set of cast rollers, etc.
- *d*) Platen, 12 x 18, complete with variable-speed motors, counter, flywheel guard, platen guard, brake, and set of cast rollers, etc.
- *e*) Proof, 14 x 18, with cabinet
- *f*) Proof, 20 x 24, with cabinet

Punch
- *a*) Foot-power, multiple, with assorted punches
- *b*) Lever, two-die, with assorted punches
- *c*) Power, multiple, with assorted punches (paper drill may be substituted)

Quoins
- *a*) Sizes No. 1 and No. 2
- *b*) Keys, Sizes No. 1 and No. 2

Rule — plain and brass (fonts to fit quarter cases)
- *a*) 2-pt., labor-saving, hair-line, side face
- *b*) 2-pt., labor-saving, 1-pt. side face
- *c*) 1-pt., labor-saving, 1-pt. face
- *d*) 2-pt., labor-saving, double face

Saw Trimmers — pedestal type, with point gauge, and raising and lowering table

Spacing Material
- *a*) Iron furniture, as selected
- *b*) Leads, labor-saving, 2-pt.
- *c*) Leads, 2-ft. strips, 2-pt.
- *d*) Slugs, labor-saving, 6-pt.
- *e*) Slugs, 2-ft. strips, 6-pt.
- *f*) Spaces and quads
- *g*) Thin spaces, brass and copper, assorted sizes, 6 to 8 pt., one size in each box

Specimen Display Board

Staple Binder — pedestal-type, foot power

Stitcher — wire, power, capacity ½ in. or ¾ in., flat and saddle-back tables

Tweezers — 3½ in.

Tympan Paper (with combination holder and cutter)
- *a*) 18 in.
- *b*) 38 in., upright, to be used with cylinder press only

Typesetting Machines
- *a*) Either linotype or intertype, 2 or 3 magazines, and molds
- *b*) Matrices for same, 6-, 8-, 10-, and 12-point, as selected

Type
- *a*) Body, lightface — 8 and 10 pt.
- *b*) Job lightface — 6, 8, 10, 12, 14, 18, 24, 30, 36, and 48 pt.
- *c*) Job, lightface italics — 8, 10, 12, 14, 18, 24, and 36 pt.
- *d*) Job, boldface — 6 and 8 pt.; 12 pt.; No. 26; 12-pt. No. 27; 12-pt., No. 28; 18-pt., No. 30
- *e*) Job, light copperplate Gothic — 6 pt. Nos. 1, 2, 3, 4; 12 pt., Nos. 5, 6, 7, 8
- *f*) Job, condensed title Gothic — 12, 18, 24, 36, 48, 60, and 72 pt.
- *g*) Job, text type — 10, 12, 14, 18, and 24 pt.
- *h*) Job, typewriter type — 12 pt. with spaces
- *j*) Job, boldface italic — 8, 10, 12, 14, 18, 24, 30 and 36 pt.
- *k*) Job, heavy copperplate Gothic — 6 pt., Nos. 21, 22, 23, and 24; 12 pt., No. 25
- *l*) Wood, condensed Gothic — 8, 12, 15 and 18 line

Supplies

Benzine or Gasoline — for cleaning type or presses

Bindery Tape — 2 in. wide, brown or black

Gold Bronze — pale

Ink
- *a*) Bond, black, for bond papers
- *b*) Book, black, for school paper, etc.
- *c*) Cover, colors as selected
- *d*) Dryers and compounds, as selected
- *e*) Halftone, black
- *f*) Job, colors as selected

(Continued on page 24A)

American Type Founders

Department of Education employs the services of Professional Educators and Experienced Engineers to aid you in the complete organization and installation of your School Printing Department

●

No. 9190 American Ideal Type Cabinet, the wise selection for many Junior High Schools

The No. 9190 American Ideal School Type Cabinet

Is especially designed for use in the Junior High Schools. The double working bank top accommodates two pupils at a time in setting type. The cabinet contains one No. 2701 Blank Case, thirteen No. 2735 California Job Cases and two No. 2765 Wells Two-font Cases—all cases full size. Where desirable, this cabinet may be ordered without overhead lead and slug rack, and with lead and slug case. A quality cabinet (Hamilton construction) economically priced.

The School Printing Department is as vital to the Educational and Social life of the school as the newspaper is to the community.

No. 870 American Perfection School Type Cabinet, the choice of many Senior High Schools

The No. 870 American Perfection School Type Cabinet

This up-to-date cabinet of steel construction in olive green finish, with working bank top sloping both ways and handy lead and slug rack under both edges of the top, provides normal accommodations for four pupils at a time in typesetting. Two pupils working at each side have between them a complete equipment of type, spacing materials and galley dump. There is no superstructure on this cabinet to obscure the instructor's view of his students. Designed for Senior High Schools and Teacher Training Institutions.

Learning by Printing is Learning by Doing

Vandercook Proof Presses

The ideal press for all hand-inking work. When equipped with register device, will do proofs in color. Vandercook presses are made in twenty-five models and sizes to meet every proving requirement. A precision press popular in all composing rooms.

Printing and Education are Inseparable

No. 1 Vandercook Proof Press

●

School printshop equipment should not only conform to the best modern practice in commercial printshops but also should be adapted to instruction conditions with due regard for efficient class management. The items here shown have been designed to meet these conditions. For the Trade or Vocational School we recommend the new "30" Line ATF equipment for the composing room and the Kelly Flat-bed Automatic Press for the pressroom.

●

We invite you to make Booth D-8-10 your headquarters while attending the N.E.A. Convention at St. Louis

Write for Information

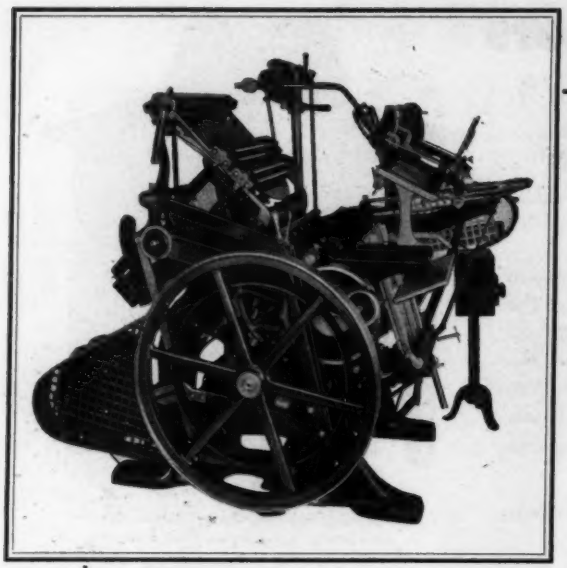
American Type Founders Department of Education

Everything for the School Printing Department

Elizabeth, New Jersey

BRANCHES AND SELLING AGENTS IN TWENTY-FIVE CITIES

Types used: Century Schoolbook Family and Stymie Black



Brandtjen & Kluge Inc.
Manufacturers
ST. PAUL, MINNESOTA

The Modern All-Purpose Press

The student of printing, about to enter a modernized and highly mechanical field of work, could have no better foundation than training on a KLUGE AUTOMATIC PRESS—a machine he will be called upon to operate in the majority of commercial shops.

Its operation is simple and fool-proof, it is up-to-date in every respect and it will safely exercise his ingenuity in the proper use of Impression, Speed, Distribution and Economy of Production.

Its versatility will also permit him the use of every variety of stock, on any kind of job, including die-cutting and embossing. The Kluge's only limitation is size.

(Continued from page 22A)

g) Metallic, gold and silver
h) Process, black, red, yellow, blue

Kerosene — for cleaning rollers

Padding Cement
a) Cold
b) Hot

Paper
a) Bond, fine grade, 17 x 22 — 20, white
b) Bond, medium grade, 17 x 22 — 20, white
c) Bond, sulphite, 17 x 22 — 20, white
d) Bond, sulphite, 17 x 22 — 20, colors as selected
e) Book, enamel, 25 x 38 — 80, white
f) Book, machine finish, 25 x 38 — 80, white
g) Book, eggshell finish, 25 x 38 — 60, white
h) Cover, as selected, 20 x 26, medium
j) Card Bristol, fine grade, 22 x 28 — 4-ply, white
k) Index Bristol, medium grade, 25½ x 30½ — 110, white
l) Index Bristol, medium grade, 25½ x 30½ — 140, white
m) Mill Bristol, medium grade, 25½ x 30½ — 140, colors as selected
n) Pressboard, red
o) Strawboard, No. 40 or No. 50
p) Tagboard, manila, 24 x 36 — 140
q) Tympan, to fit presses
r) Wrapping paper, size as selected
s) Holder for same

Paste
a) Bindery
b) Make-ready

Twine — cotton, for tying jobs

Wire Stitching
a) No. 25 round wire for stitcher
b) Wire staples, ¼ in.

COURSE IN ELECTRICITY FOR THE JUNIOR HIGH SCHOOL

(Continued from page 20A)

tricity, The Bruce Publishing Co., Milwaukee, Wis.

Kuehn, *Mathematics for Electricians*, McGraw-Hill Book Co., New York City.

Kuns, *Automotive Electrical Practice*, McGraw-Hill Book Co., New York City.

Millikan and Gale, *A First Course in Physics*, Ginn and Company, Boston, Mass.

Morgan, A. P., *The Boy Electrician*, Geo. G. Harrap and Co., Ltd., Kingsway, London, England.

Morris and Smith, *Shop Arithmetic*, McGraw-Hill Book Co., New York City.

Moyer and Wostrel, *Practical Radio*, McGraw-Hill Book Co., New York City.

Poppe, *House Wiring*, The N. W. Henley Co., New York City.

Schuler, *Electric Wiring*, McGraw-Hill Book Co., New York City.

Sloane, *Electrician's Handybook*, N. W. Henley Co., New York City.

Sloane, *Electricity Simplified*, N. W. Henley Co., New York City.

Smith, *Direct Current Electricity*, McGraw-Hill Book Co., New York City.

Swope, *Lessons in Practical Electricity*, D. Van Nostrand Co., New York City.

Tustison, F. E., *Job Sheets for the Practical Electrical Shop*, The Bruce Publishing Co., Milwaukee, Wis.

Free Books and Catalogs

1. Catalog, Graybar Electric Co., New York City.
2. Physical Apparatus and Instruments, catalog F, Central Scientific Co., Chicago, Ill.
3. Starrett Tools, catalog, Athol, Mass.
4. Drawing Instruments, catalog, Keuffel & Esser, New York City.
5. Catalog, Welch Scientific Co., Chicago, Ill.
6. Catalog and diagrams, Ward-Leonard, Chicago, Ill.
7. Coil Windings, bulletin No. 10, Belden Mfg. Co., Chicago, Ill.
8. Alloys for Electrical Resistance, catalog B, Alloy Metal Wire Co., Moore, Pa.
9. Fire Alarm Systems, catalog No. 16–17, Stanley and Patterson, New York City.
10. Vitrohm Dimmers, bulletin No. 75, Ward-Leonard, Mt. Vernon, N. Y.
11. Mobile Color Lighting, bulletin, 74, Ward-Leonard, Mt. Vernon, N. Y.
12. Mannheim Slide Rule, booklet, Keuffel & Esser, New York City.
13. The Magic of Communication, booklet, American Telegraph and Telephone Co., New York City.
14. Things Worth Knowing About the Telephone, American Telegraph and Telephone Co., New York City.
15. Types of Fuses, exhibit, Bussman Mfg. Co., St. Louis, Mo.
16. The Refrigerating Cycle, chart, Copeland Co., Detroit, Mich.
17. The Storage Battery, chart, Philadelphia Storage Battery Co., Philadelphia, Pa.
18. The Storage Battery, chart, exhibit, Edison Storage Battery Co., Orange, N. J.
19. Construction Data, 3-phase Induction Motor, General Electric Co., Schenectady, N. Y.
20. Construction Data, Single-phase In-

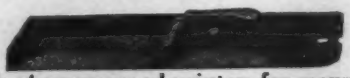
(Continued on page 26A)

Rouse PRINTSHOP TOOLS FOR APPRENTICE AND MASTER

American Lead and Rule Cutters

There is a ROUSE Lead and Rule Cutter to meet every requirement. All are precision built, the development of 35 years of manufacturing tools for printers.

ROUSE Composing Sticks



Recognized as the standard among good printers for many years. There is a size and style for every requirement. Each student should own a stick.

ROUSE Mitering Machines

ROUSE Hand and Power Miters lead the field for accuracy and performance. A wide range of models permits easy selection for school work—at a price within your budget.

Send for prices and catalogs

H. B. ROUSE & CO., 2214-16 Ward St., Chicago

You USE them - - -

We MAKE and STOCK them

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Different Sizes, Grades and Weights of stock.

SEND US YOUR LIST OF REQUIREMENTS FOR 1935 - 1936

Samples and Prices Gladly Furnished

The Western States Envelope Co.

West Pierce St. at 16th Street Viaduct
MILWAUKEE WISCONSIN

EQUIP YOUR PRINT SHOP WITH C & G SAW TRIMMERS

C & G Saw Trimmers are production saws used in leading printing and publication plants throughout the world.

They are designed exclusively for efficient use in the composing room. They have many features which make them desirable school print shop saws.

SAFETY

A positive work holder, and guards which almost completely cover grinder and saw blade afford utmost protection in sawing, trimming, and mitering operations.

ACCURACY

Precision construction and several special C & G features give the accuracy essential to fine printing.

SPEED

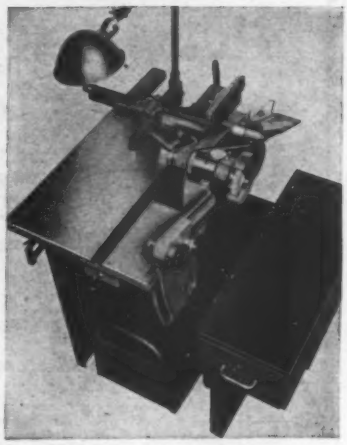
C & G Saw Trimmers are designed to meet the speed demands of modern production. Waste motion is reduced to a minimum in every operation.

STURDINESS

Heavy use of the composing room saw demands sturdy construction. C & G Saw Trimmers are built for maintained accuracy and long life.

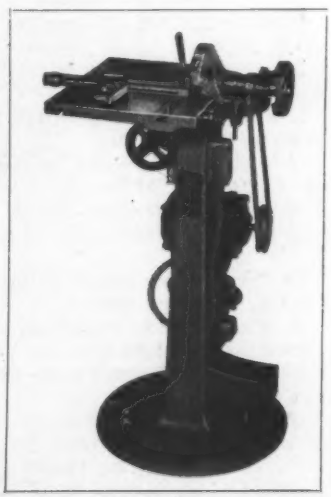
ECONOMY

C & G Saw Trimmers are reasonably priced, yet they meet every composing room need, and have many exclusive advantages found in no other saw. The upkeep cost is negligible. Many have been in operation for years without a single repair.



No. 3 C & G CABINET MODEL SAW TRIMMER

The New No. 3 C & G Saw Trimmer is entirely new in design and construction. It is the most productive saw trimmer made, offering the utmost in high-speed accuracy in sawing, trimming, and mitering.



No. 2 C & G SAW TRIMMER

The No. 2 C & G Saw Trimmer has many recent developments which make it an excellent saw where the capacity of the No. 3 is not necessary. It has proved itself to thousands of printers. It is equipped with the C & G work-holding device which contributes so greatly to saw trimmer safety. The No. 2 is low priced.

Write for Free Catalog

MILWAUKEE SAW TRIMMER CORPORATION

612 East Clybourn Street :: :: Milwaukee, Wisconsin

R·MURPHY
STAY SHARP
TRADE MARK
EST. 1859
KNIVES
MADE SHARP AND STAY SHARP

HOW THEY CUT!

No. 0. SLOYD. Blade 1¾ in. long
No. 2. SLOYD, Blade 3¼ in. long
No. 1. SLOYD, Blade 2⅝ in. long
No. 3. SLOYD, Blade 3 in. long
No. 1½. SLOYD, Blade 3 in. long.
No. 2½M. MANUAL TRAINING, Blade 2½ in. long
No. 1½C. CARDBOARD, Blade 1½ in. long
STENCIL AND WOOD BLOCK KNIFE, Blade 2½ in. long.

ROBERT MURPHY craftsmen are specialists in the making of guaranteed quality knives for any purpose. 86 years of experience and research, enables them to give you knives you can depend upon. They will stand up under abuse and constant use and still hold a keen cutting edge.

Send for complete catalog and prices.

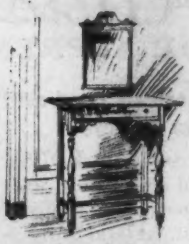
ROBERT MURPHY'S SONS CO.
AYER Established 1859 MASS.

THE KLISE BOOK OF PROJECTS

20 Sketches of the completed projects

20 Working Drawings of projects including

Martha Washington Sewing Cabinet, End Tables—Console and Mirror, Student's Desk—Magazine Racks—Cedar Chests—Book Ends, Etc.



Mouldings, ropes, beads, rosettes and hardware used on projects are illustrated and priced.

A charge of 50 cents is made for the book. This charge is rebated on order of $2.50 or more. (This offer subject to change without notice.)

Small sample assortment of mouldings for school shop on request.

KLISE MANUFACTURING CO. INC.
GRAND RAPIDS, MICHIGAN

(Continued from page 24A)

duction Motor, General Electric Co., Schenectady, N. Y.

21. Elkon Bulletin, P. R. Mallory & Co., Weehawken, N. J.

22. Use of Drawing Instruments, Eugene Dietzgen, New York City.

23. Industrial Controllers, catalog, General Electric Co., Schenectady, New York.

24. Insulating Products, exhibit, American Chemical Products Co., Rochester, N. Y.

25. The Dry Cell, exhibit, National Carbon Co., New York City.

26. The Dry Battery Handbook, National Carbon Co., New York City.

27. Wires and Cables, Okonite-Callender Co., Passaic, N. J.

28. Motors and Transformers, manual. Wagner Electric Co., St. Louis, Mo.

29. Visual Instruction, booklet, General Electric Co., Schenectady, N. Y.

30. Booklet of Films, American Steel & Wire Co., Chicago, Ill.

31. Booklet of Films, Westinghouse Electric Co., East Pittsburgh, Pa.

32. Evans, P.E.D. Equipment, catalog, Central Scientific Co., Chicago, Ill.

33. Radio Catalog, American Sales Co., New York City.

34. Booklet of Films, Western Electric Co., Motion Picture Bureau Service, New York City.

35. Ford Film Service, Ford Motor Co., Long Beach, Calif.

36. U. S. Department of Commerce, Washington, D. C.

37. U. S. Bureau of Mines, Washington, D. C.

Guidance References

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Descriptions of Occupation, U. S. Department of Labor, Washington, D. C.

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Rodgers and Belman, *My Vocational Guidebook*, The Bruce Publishing Co., Milwaukee, Wis.

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Sacket, *The Engineer: His Work and His Education*, Ginn & Co., New York City.

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Williams, S. J., *Manual of Industrial Safety*, McGraw-Hill Book Co., New York City.

Beyer, S., *Industrial Accident Prevention*, Houghton-Mifflin Co., Boston, Mass.

Cathcart, E. P., *Human Factor in Industry*, Oxford University Press, New York City.

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Hamilton, Alice, *Industrial Poisons in the United States*, Macmillan Co., New York City.

Hayhurst, E. R., *Industrial Health Hazards and Occupational Diseases*, Ohio Board of Health.

Henderson and Haggard, *Noxious Gases*, Chemical Catalog Co., Inc., New York City.

Kober, G. W. and Hayhurst, E. R., *Industrial Health*, P. Blakiston's Son & Co., Philadelphia, Pa.

Resnick and Garris, *Eye Hazards in Industrial Occupations*, National Society for the Prevention of Blindness, Inc., New York City.

White, R. P., *Dermatosis or Occupational Diseases of the Skin*, H. K. Lewis & Co., London, England.

Safe Practices Pamphlets — 1. Ladders; 2. Belt Shifters and Belt Shippers; 7. Belts and Belt Guards; 8. Shafting, Couplings, Pulleys, Gears, Sprockets and Chains; 13. Grinding Wheels; 14. Goggles; 20. Woodworking Equipment; 39. Machine Shop Machinery; 41. Hand Tools; 73. Safety in Foundries; Shop Safety; How to Keep from Getting Hurt, National Safety Council, Chicago, Ill.

Metal-Working Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Air Compressors — for machine shop, foundry, or forge shop
Anvil — 100-lb.
Arbor Press — bench or pedestal type
Barrows
- *a*) Coke
- *b*) Foundry
- *c*) Scrap

Belt Lacer
Benches
- *a*) Coremaking
- *b*) For metal working, iron or steel legs. Tops, metal or hardwood lumber, 1¾ in. to 2½ in. thick
- *c*) Molding

Blackboard — permanent or portable
Blowers — for furnaces, forges, etc.
Blowtorch — 1 qt. size
Bookcase — for reference books, catalogs, etc.
Boring Bar
Boring Mill — vertical or horizontal
Bulletin Board
Cabinets — Wood or metal, for filing class records, instruction sheets, drawings, etc., and for tools and supplies
Casehardening Boxes
Centering Machine
Chain Hoists — differential, duplex or triplex
Chairs — teacher's and tablet-arm, if needed for related-subjects room, or for demonstration section
Chuck
- *a*) Drill, selected sizes
- *b*) Lathe, combination, 4-jaw, selected sizes
- *c*) Lathe, independent, 4-jaw, selected sizes
- *d*) Lathe, universal 3-jaw, selected sizes
- *e*) Milling machine, universal

Core Oven — for foundry
Cranes and Hoists — air, electric or hand, of the jib, traveling, or portable type
Cupola — for foundry, coke, or electric, ¼ to 1-ton capacity
Desk — teacher's, with drawer compartments
Die-Filing Machine
Dividing Head
Drills
- *a*) Bench, hand
- *b*) Breast
- *c*) Electric, portable
- *d*) Hand
- *e*) Post, hand or power
- *f*) Radial
- *g*) Sensitive
- *h*) Upright, power

Flasks — 2 or 3 part, steel or snap type
Forge — coal or gas, with hand or electric-driven blower
Furnaces
- *a*) Annealing
- *b*) Bench
- *c*) Brass and soft metal
- *d*) Combination bench
- *e*) Casehardening
- *f*) Cyanide
- *g*) Gasoline
- *h*) Heat treating
- *j*) Melting

Gear-Cutting Machine
Grinder
- *a*) Bench, hand or power driven
- *b*) Combination grinder, buffer and polisher
- *c*) Emery, bench or pedestal type
- *d*) Face, with magnetic chuck
- *e*) Portable tool post
- *f*) Precision, for external and internal grinding
- *g*) Universal tool cutter, drill and reamer grinder
- *h*) Wet tool

Hack Saw — motor or belt driven
Hand Picks — for cleaning inside of cupola, 1¼ to 2½ lb.
Hardness Testing Machine
Lathes — belt or individual drives
- *a*) Automatic
- *b*) Bench, 6 in. to 11 in. swing, 11 in. to 36 in. between centers
- *c*) Change gear, 9 in. to 14 in. swing, 18 in. to 36 in. between centers
- *d*) Quick-change gear, 9 in. to 16 in. swing, 18 in. to 36 in. between centers
- *e*) Semiquick-change gear, 9 in. to 18 in. swing, 18 in. to 42 in. between centers
- *f*) Turret

Milling Machine
- *a*) Plain, cone or motor-driven type
- *b*) Universal, cone or motor-driven type

Nibbling Machine
Pipe Cutter
Planer — belt or motor driven
Power Hammer — for forging operations
Punches — metal, hand, or power
Pyrometer
Pyroscope
Relieving Attachment for Lathe
Sand Sifter — for foundry, hand or power
Sandblast Outfit — with cabinet
Scale
- *a*) Counter for machine shop
- *b*) Platform, for foundry, 1000-lb. capacity

Shaper
Slotter
Snap-Flask Jackets — to fit snap flasks used
Straightening Press
Surface Plates
Swage Block and Stand — for forge shop
Taper Attachment for Lathe
Truck — warehouse
Tumbling Barrel — for foundry
Vises
- *a*) Blacksmith
- *b*) Drill press
- *c*) Machinist
- *d*) Pipe
- *e*) Planer
- *f*) Shaper

Welding Outfit
- *a*) Acetylene
- *b*) Electric

Metal Working—Small Tools

Arbors
- *a*) Drill chuck to suit requirements
- *b*) Reamers, various sizes
- *c*) Shell tool, various sizes
- *d*) Straight shank for shell reamers and shell drills, selected sizes
- *e*) Taper shank for shell reamers and shell drills, selected sizes

Bearing Scraper
Bellows — for foundry class
Bevel Protractor
Brooms and Floor Brushes — for shop and foundry
Brushes
- *a*) Bench
- *b*) Core box
- *c*) Core painting
- *d*) Hard brushes for foundry
- *e*) Floor
- *f*) Soft brushes for foundry

Bulb Sponges — for molders
Draw Pins — for molders
Calipers
- *a*) Hermaphrodite, 4 in. and 6 in.
- *b*) Inside, 4 in. and 6 in.
- *c*) Outside, 4 in. and 6 in.

Cans
- *a*) Oil, 1/3-pt., 1-pt., and 10-gal.
- *b*) Waste

Center Testers
Chisels
- *a*) Cape, 3/8 in. and 5/8 in.
- *b*) Cold, 5/8 in. and ¾ in.
- *c*) Diamond point, 3/8 in. and ½ in.
- *d*) Round nose, 3/8 in. and ½ in.

Clamps
- *a*) 4 in., 6 in., 8 in., and 10 in.
- *b*) Flask, for foundry
- *c*) Strap, various sizes

Coke Forks — for foundry
Collets
- *a*) For milling machine, selected sizes
- *b*) For lathe, selected sizes

Combination Squares — with hardened head and blade, and protractor head, 9 in. and 12 in.
Counterbores — straight and tapered shanks, selected sizes
Countersinks — for metal
Crucible Tongs — to fit crucibles
Crucibles — selected sizes
- *a*) Shanks, single-end to fit ladles
- *b*) Shanks, hand, to fit ladle bowls

Cutters — angular-milling, bevel-gear, concave-milling, convex-milling, end-milling, face-milling, formed-milling, grooving, involute gear teeth, key-seat, side-milling, and metal-slitting
Dividers — Spring, 4 in. and 6 in.

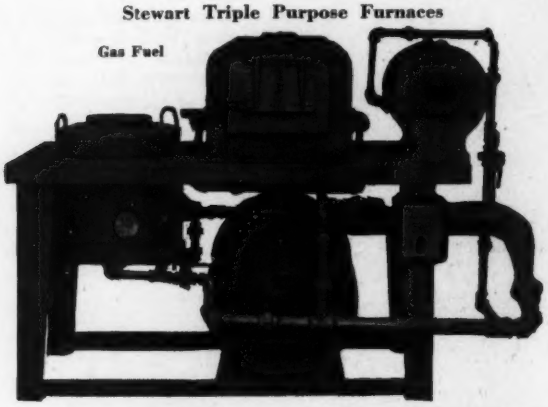
(Continued on page 30A)

FURNACES STEWART FORGES

The furnaces and combinations here shown are just several of a variety designed and developed for the school shop

Stewart Triple Purpose Furnaces

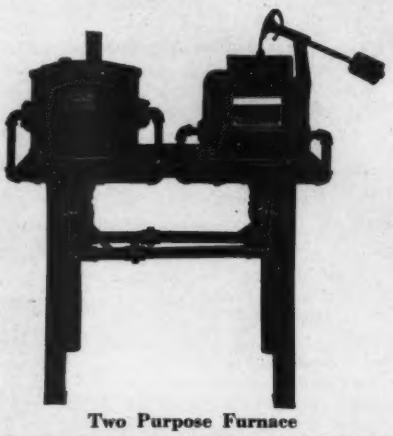
Gas Fuel



These series of combination furnaces are compact and very popular for educational purposes—an assembly of three types of our Stewart Standard Furnaces

Crucible Section
Oven Section
Forge or High Speed Section

These units make a complete plant covering practically the whole range of heat treating. Write for particulars.



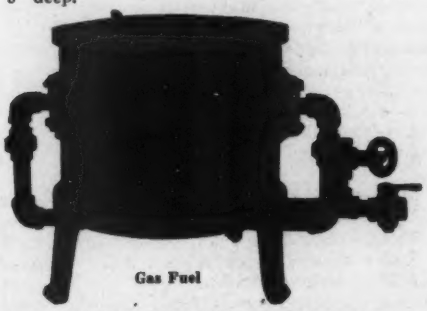
Two Purpose Furnace

Excellent for lead hardening or other liquid heat hardening. Can be used for melting soft metals. Is fitted with Stewart pressed steel pot 6″ diameter x 6″ deep or 6″ diameter x 8″ deep.

No. 1 Stewart Soldering Iron Heater

A very solidly built heater that is large enough to accommodate two 4-lb. irons. The flame is projected upward from the bottom and thoroughly envelops the irons with a rapid uniform heat. Lined with heavy firebrick and enclosed in a sheet iron cover.

Bench space .....16″ x 11″
Shipping weight .....80 lbs.

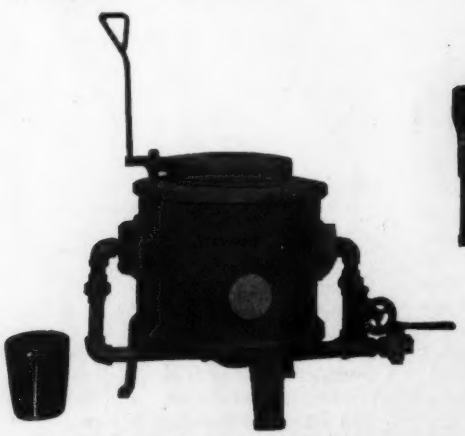


Gas Fuel

No. B68 Round Pot Furnace

This bench type unit is equipped with a 6″ diameter x 8″ deep pressed steel pot for lead or salt hardening. Can also be used for oil tempering. Lined with with heavy refractories and fired so that no flame strikes the pot direct.

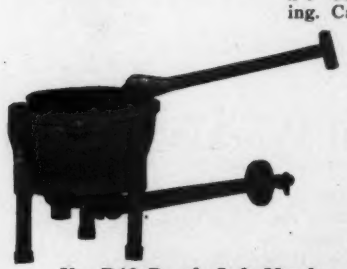
Height .....19″
Bench space .....20″x24″
Shipping weight.....170 lbs.



No. 4A Bench Metal Melting Furnace

This melter is fitted with a No. 4 Graphite crucible, lined with heavy firebrick and fitted with a swinging cover for the melting of brass, copper, and aluminum. Fast, quick heats assured.

Height .....19″
Bench space .....20″ x 24″
Shipping weight .....180 lbs.



No. B40 Bench Soft Metal Melting Furnace

Although small in size, this unit has a capacity of 40 lbs. of lead. Suitable for the melting of any soft metals. Cast Iron shell, lined with insulation, and fitted with a cast iron pot with handle for removing and pouring. Atmospheric Burner.

Pot.....6″ diameter x 5″ deep
Bench space.....12″ x 20″
Height .....10″
Shipping weight.....55 lbs.

No. 2M Combination Soldering Iron Heater and Melting Pot

A very compact, sturdy and efficient gas heater for Soldering Irons. The flame is projected upward from the bottom and surrounds the irons, heating them rapidly and uniformly. Heavy cast iron body, lined with heavy firebrick. Retains the heat and does not burn out.
Pot on top for melting soft metals.
Will accommodate two 4-lb. irons.

Floor space.....16″ x 11″
Atmospheric or blast burners
Shipping weight.....100 lbs.

No. 152 Forge
Ideal for Small Work

This unit is very handy and one that can be placed conveniently on a bench or small table for the heating of small pieces to be forged, for the heating of rods for bending, for tool dressing, and for the taking of end heats. It has a small opening at both ends so that center heats can be taken or it can be worked from both ends. Ideal where a quick intense heat is required. The top is removable so that a wide variety of work can be handled.

Entrance.....1¼" x 1¼"
Bench space.....12" x 12"
Overall height.....15"
Shipping weight.....60 lbs.

Stewart Standard Ovens

Indirect heat and equipped with a U-shaped hearth slab so that no flame comes in a direct contact with the work. Will handle a wide variety of work, such as annealing, carburizing, tool and die hardening, and general heat treating suitable for temperatures up to 2000 deg. Fahr.

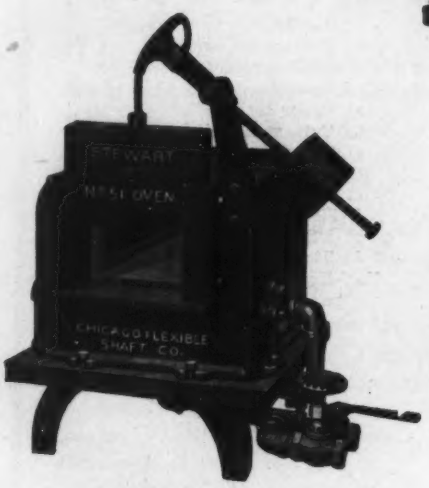
STANDARD SIZES

5" wide x 9" high x 13½" deep
and larger

SK 248 Forge

A well built forge designed for tool dressing, rod end work, heating for bending, welding, the taking of center heats, and many other purposes where a fast high heat is required. Fitted with air curtain in front to protect the operator and equipped with a proportional gas and air mixer and a quenching tank with rack for tongs.

Opening.....4" wide x 2" high
Heating depth.....8"
Rear opening.....3" diameter
Shipping weight.....450 lbs.



No. 51 Bench High Speed Oven

This small under-fired furnace signed for high speed steel hardening where quick, high heats are essential has a carbofrax U-shaped hearth and no flame can strike the work direct. Suitable for temperatures of 2450 deg. Fahr. Built of Stewart quality throughout.

Opening.....3" high x 5" wide
Heating depth.....6"
Bench space.....20" x 13"
Shipping weight.....200 lbs.

Stewart No. 28 Bench Oven

Here is a very handy furnace for general shop work, lined with heavy first quality refractories and of the under-fired type, for the heat treatment of carbon and high speed steel. Fitted with U-shaped hearth. Adapted to annealing, carburizing, tool and die hardening, and general heat treating.

Opening.....4" high x 8" wide
Heating depth.....12"
Bench space.....24" x 24"
Shipping weight.....550 lbs.

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Atlanta, Georgia

For complete specifications and catalogs, write

CHICAGO FLEXIBLE SHAFT COMPANY, 5529 W. Roosevelt Road Chicago, Illinois

(Continued from page 27A)

Drill
- *a*) Drifts, different sizes
- *b*) Drill sleeves, different sizes
- *c*) Stand for Nos. 1 to 60
- *d*) Stand for 1/16 in. to ½ in. by 64ths

Drills
- *a*) Center
- *b*) High-speed, taper shank, various sizes
- *c*) Jobbers, straight shank, 1/16 in. to ½ in. by 64ths
- *d*) Ratchet
- *e*) Straight shank, Nos. 1 to 60
- *f*) Taper shank, ½ in. to 1 in. by 16ths

Emery — rubstones for cleaning castings in foundry

File Cards

Files
- *a*) Die sinkers, various shapes
- *b*) Flat bastard, 8 in. and 10 in.
- *c*) Half-round, double cut, 6 in., 8 in., and 10 in.
- *d*) Hand, smooth, 8 in. and 10 in.
- *e*) Mill, smooth, 8 in. and 10 in.
- *f*) Round bastard, 8 in.
- *g*) Square bastard, 8 in.
- *h*) Swiss, various shapes
- *j*) Three-square, double cut, 6 in.
- *k*) Warding, double cut, 6 in.

First-Aid Cabinet and Supplies

Forge Tools — drift pins, flatters, fullers, hand and handle punches, hardies, hot and cold cutters, set hammers, and swages for the forge shop

Gate Sticks — maple, for foundry

Gauges
- *a*) Center
- *b*) Depth
- *c*) Drill and wire
- *d*) Screw pitch, select kinds
- *e*) Surface

Gloves — asbestos, for foundry

Goggles
- *a*) For machine shop
- *b*) For foundry

Hack Saw
- *a*) Blades, hand, 18T, 10 in.
- *b*) Blades, power, 14T, 12 in.
- *c*) Frames, adjustable

Hammers
- *a*) Babbitt
- *b*) Ball-peen, 13-, 16-, or 20-oz.
- *c*) Blacksmith's, various kinds
- *d*) Riveting, 9- and 12-oz.
- *e*) Setting

Indicator
- *a*) Center
- *b*) Universal or universal dial test
- *c*) Speed

Knurling Tool — with assorted knurls

Ladles
- *a*) Bull
- *b*) Hand bowls
- *c*) Melting

Lathe Dogs — ½ in., ¾ in., 1 in., 1½ in., 2 in., 2½ in., and 3 in.

Leggins — fireproofed duck, to protect students when pouring in foundry

Level — 6 in. bench

Lifting Screws — for molders

Mallets — wood or soft

Mandrels — selected sizes

Micrometers — inside, 1½ in. to 8 in.; outside, 0 to 1 in.; outside, 1 in. to 2 in.; outside, 2 in. to 3 in.

Molding Boards

Molding Sticks and Trowels — various kinds

Nippers — end-cutting, 5 in.

Oil Storage Tank — with pump

Oilstones — medium and fine

Pails — galvanized, 12-qt. capacity for foundry

Parallels
- *a*) Adjustable
- *b*) Steel, assorted sizes

Pliers
- *a*) Combination, 6 in.
- *b*) Side-cutting, 6 in.

Punches
- *a*) Center, ¼ in. and ⅜ in.
- *b*) Hollow, ½ in., ¾ in., and 1 in.
- *c*) Pin, ⅛ in., 5/32 in., 3/16 in., 7/32 in., and ¼ in.
- *d*) Prick, ¼ in.

Rammers — for foundry
- *a*) Hand
- *b*) Floor

Reamers — various sizes
- *a*) Adjustable
- *b*) Hand
- *c*) Taper pin
- *d*) With taper shank

Riddles — ¼ in. and ⅛ in. mesh, 18 in. diameter, for foundry

Rivet Sets — assorted sizes

Scales
- *a*) Steel, 6 in., graduated 1/64 in. to ⅛ in.
- *b*) Steel, 12 in., graduated to 32nds

Screw Drivers — 6 in. and 9 in. blade

Scribers

Shovels
- *a*) Coke
- *b*) Sand

Snips — tin, 3 in. straight and 3 in. curved

Sockets — for taper shanks, drill and tools, selected sizes

Soldering Coppers and Handles — 1-lb. size

Spray Can — for molders

Sprinkling Cans — galvanized iron, 16-qt. capacity, for foundry

Sprue Picks — for molders

Squares
- *a*) Machinists', 6 in.
- *b*) Blacksmith's

Steel Figures, ⅛ in.

Steel Letters — ⅛ in.

Swabs — for molders

Tapeline — steel, 25 ft.

Taps and Dies
- *a*) Machine screws
- *b*) Pipe
- *c*) S.A.E. ¼ in. to ¾ in.
- *d*) U.S.S. ¼ in. to ¾ in.

Tongs
- *a*) Blacksmith's, various kinds
- *b*) Pick-up, for foundry
- *c*) Shake-out, for foundry

Tool Holders
- *a*) Boring tools
- *b*) Cutting-off tools
- *c*) Planer
- *d*) R.H. and L.H. offset shank
- *e*) Shaper
- *f*) Slotter
- *g*) Straight shank
- *h*) Threading

Tool-Holder Bits — square, ¼ in., 5/16 in., ⅜ in., 7/16 in., ½ in.

Trammel Points

V Blocks and Clamps

Wheel Dresser

Wrenches
- *a*) Adjustable, 8 in. and 10 in.
- *b*) Pipe, 8 in. and 12 in.
- *c*) Tap, adjustable, various sizes

Metal Working—Materials and Supplies

Abrasive Wheels

Acetylene Gas — in drums for welding

Aluminum
- *a*) Pigs for foundry
- *b*) Sheets, tubing, rounds, shapes, wire, etc.

Babbitt Metal

Bearing Blue

Belt Dressing

Belt Lacing Material

Belt Leather

Bolts
- *a*) Carriage, selected sizes
- *b*) Lag, selected sizes
- *c*) Machine, selected sizes
- *d*) S.A.E., selected sizes
- *e*) Stove, flat or round heads, selected sizes

Brass
- *a*) Bars, 3/32 in., ⅛ in., 4/16 in., and ¼ in. thick; ⅜ in. to 1 in. wide, 8 ft. to 10 ft. long, selected sizes
- *b*) Round rods, 3/16 in. to ½ in. by 16ths, selected sizes
- *c*) Sheets, 28 to 32 American gauge, 12 in. wide x 72 in. to 84 in. long, selected sizes
- *d*) Strips, 1/32 in. and 1/16 in. thick, ½ in. to 1½ in. wide, 50 ft. to a coil, selected sizes
- *e*) Threaded rods, Nos. 6 to 10, in 24 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes
- *f*) Wire, soft, 8, 11, and 14 American gauge, selected sizes
- *g*) Wire, spring, 8 to 22 American gauge, selected sizes

Casehardening Compounds

Chaplets — single and double head

Coal
- *a*) Charcoal for foundry or forge
- *b*) Coke for foundry
- *c*) Forge

Copper
- *a*) Pigs, for casting alloys
- *b*) Sheets, 8 to 25 American gauge, 30 in. x 60 in., selected sizes
- *c*) Tubing, outside diameters, 3/16 in., ¼ in., 5/16 in., ⅜ in., ½ in.; thickness of wall, 1/32 in.; lengths, 8 ft. to 12 ft., selected sizes
- *d*) Wire, soft, 2 to 20 American gauge, in coils. Also in ¼-, ½-, and 1 lb. spools, sizes 16 to 36, English gauge, selected sizes

Core
- *a*) Compounds
- *b*) Flour
- *c*) Paste
- *d*) Oil
- *e*) Wax-vent wire

Cutting Compounds

Emery Paper and Cloth — Nos. 00, 0, ½, 1, obtainable in sheets or rolls, selected sizes

Fire Bricks and Clay — for foundry

Fire Handles — assorted sizes

(Continued on page 32A)

SPECIFY DIXON ART METAL TOOLS

Metal Arts courses are being featured in a constantly increasing number of American High Schools.

The very best use of an appropriation, large or small, will be made by standardizing on Dixon Tools and Equipment.

Dixon Tools for Art Metal work are known for superior quality, design and up-to-dateness to instructors and craftsmen everywhere.

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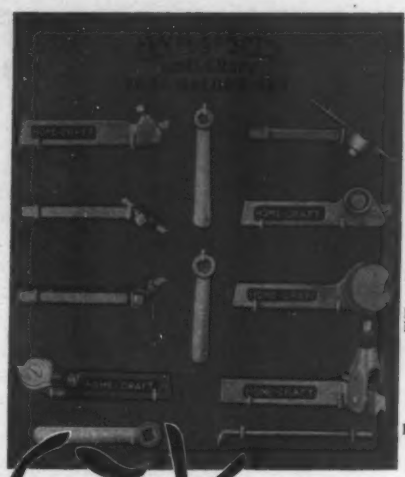

Williams' "Homecraft" set consists of the following tools which may be purchased individually if desired:

No. 00-S Turning-Tool Straight Shank

No. 00-L Turning-Tool L. Hand Offset Shank

No. 00-R Turning-Tool R. Hand Offset Shank

No. C-50 Threading-Tool with Formed Cutter

No. 030-R Cut-Off Tool R. Hand Offset Shank

No. 020-R Cut-Off Tool R. Hand Straight Shank

No. 00-K Knurling-Tool Self-centering Head; Diamond Patteru Knurls

No. 15 Boring-Tool Reversible for R. and L. Hand Use.

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LATHE DOGS

TOOL HOLDERS
ALL PATTERNS

"C" CLAMPS

DETACHABLE SOCKET WRENCHES

and other DROP-FORGED SPECIALTIES

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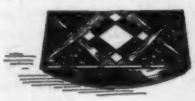
SUPERIOR DROP-FORGED TOOLS

ART METAL and WROUGHT IRON

Fast Becoming the Most Popular Subject.



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The interest of Industrial Arts Teachers in what we have created has been beyond all expectation. We ascribe this to our sincere endeavor to promote only the finest from the Artist's and Artisan's viewpoint.

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All of the above is more fully described in our free explanatory literature. Complete Catalog will be sent free to Teachers interested in Metal Work.

THE WROT IRON DESIGNERS

541 West 35th Street, New York, N. Y.

(Continued from page 30A)

Graphite — for foundry
Iron — Pig, for foundry
Lacquer — transparent and colored, for finishing
Nuts — S.A.A., acorn cap, castellated, square, hexagon, joint, and wing, selected sizes and kinds
Oil
- *a*) Boiled linseed
- *b*) Lubricating
- *c*) Quenching and hardening

Packing
Round, sheet, square, or tubular
Paint — black asphaltum
Pins
- *a*) Cotter, 3/32 in. to ¼ in. diam. from ½ in. to 2 in. long
- *b*) Flask, for flask repairs
- *c*) Taper, Nos. 0 to 6, ¾ in. to 2 in. long

Pumice Powder
Rivets
- *a*) Copper, with burrs, Nos. 7 to 14, lengths, ⅜ in. to ¾ in., selected sizes
- *b*) Iron, No. 14 gauge to 3/16 in., flat-head or button-head, ¼ in. to 1 in. long, selected sizes
- *c*) Tinners', flat-head, 8-oz. to 16-lb., either tinned or black, selected sizes

Sand
- *a*) Molding, in 350-lb. barrels or 800-lb. casks
- *b*) Parting, in 350-lb. barrels or 800-lb. casks

Screws
- *a*) Flat-head or round-head iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds
- *c*) Set, head and headless

Solder — acid or rosin core; bar, or solid wire
Soldering Paste or Salts
Steel
- *a*) Bessemer, rod, 1/64 in. to ⅜ in. by 64ths, in 4 ft. lengths, selected sizes
- *b*) Bars, cold-rolled, ⅛ in. to ⅜ in. thick, ½ in. to 2 in. wide, 12 ft. lengths, selected sizes
- *c*) Drill rod, letter sizes, A to Z, number sizes, 1 to 80, in 3 ft. lengths, selected sizes
- *d*) Rods, hexagon and square, cold-rolled, ¼ in. to ¾ in., in 12 ft. lengths, selected sizes
- *e*) Round, cold-rolled, diameters ⅛ in. to 1 in., lengths 12 ft., selected sizes
- *f*) Sheet, black, Nos. 18, 20, 22, 24, 26, 28 U.S. gauge; size of sheets, 24 in., 28 in., and 30 in. x 96 in.
- *g*) Sheet, galvanized, Nos. 18, 20, 22, 24, 26, 27, and 28 U.S. gauge; size of sheets, 24 in., 28 in., and 30 in. x 96 in., selected sizes
- *h*) Threaded rods, Nos. 6 to 10, in 12 in. lengths. Nos. 12, 14, ¼ in., and 5/16 in., in 24 in. lengths, selected sizes

Tin
- *a*) Pigs, for casting alloys
- *b*) 1C, 1X, 20 in. x 48 in.
- *c*) 1XX, 20 in. x 48 in.

Washers and Burrs
- *a*) Copper, burrs, Nos. 3 to 14, in 1-lb. boxes
- *b*) Iron burrs, Nos. 3 to 14, in 1-lb. boxes
- *c*) Brass washers, 3/16 in. to ½ in. by 16ths
- *d*) Iron washers, 3/16 in. to ½ in. by 16ths

Welding Fluxes
Welding Rods (all rods come in 24 in. lengths)
- *a*) Brazing, 1/16 in., ⅛ in., and 3/16 in. diameter
- *b*) Cast aluminum, 3/16 in., ¼ in., and ⅜ in. diameter
- *c*) Cast brass, 3/16 in., and ⅜ in. diameter
- *d*) Cast bronze, ¼ in. diameter
- *e*) Cast copper, 3/16 in. and ¼ in. diameter
- *f*) Cast iron, 3/16 in., ¼ in., 5/16 in., and ⅜ in. diameter
- *g*) Low carbon steel, ⅛ in., 3/16 in., and ¼ in. diameter

White Lead — for machine shop
Wire
- *a*) Annealed, 16 to 34 English gauge, selected sizes
- *b*) Coppered market, 5 to 18 English gauge, selected sizes
- *c*) Coppered spring, 2 to 18 English gauge, selected sizes
- *d*) Galvanized, 5 to 18 English gauge, selected sizes
- *e*) Piano, Nos. 00 to 36, selected sizes
- *f*) Tinned, 16 to 24 English gauge, selected sizes
- *g*) Wool, Nos. 0 to 3 in 1-lb. packages, selected sizes

Zinc
- *a*) Pigs, for casting alloys
- *b*) Sheet, Nos. 4 to 14, sheets 36 in. x 84 in.

ART METAL and JEWELRY WORK EQUIPMENTS and SUPPLIES

We make a specialty of equipping and supplying schools, clubs and summer camps for this work and carry all kinds of materials used, including gold, silver, copper, brass, pewter aluminum and nickel silver, in sheet and wire form, and semi-precious stones.

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The first to be used in school work. Beware of inferior substitutes. **Specify "Rose"** when ordering.

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Our new and enlarged catalog R will be sent free to shop and craft teachers upon application if position is stated. To others it will be 25c. Full credit given on first order amounting to $5.00.

Metal Crafts Supply Co.
37 Aborn St., Providence, R. I.

FIGURE THE DIFFERENCE

When you consider the difference in costs between *good* tools and just any old tools—and when you consider the effect that difference may make in a boy's work . . . is it worth it? Crude tools breed mistakes and the habit of carelessness. Good tools inspire precision. Start your boys *right*—with Starrett Tools—the choice of skilled workmen in every trade.

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FOR VISES SPECIFY "MORGAN"

They don't cost any more. Are unsurpassed for strength, rigidity and durability. Guaranteed against breakage. Any part broken in service replaced free of charge. When through wear it becomes necessary to replace parts, this is easily accomplished because special machining allows interchangeability of all parts.

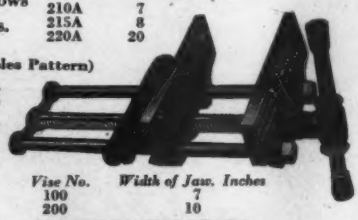
CONTINUOUS SCREW PARALLEL BAR VISE

Adjustable Steel Handle—Stop in Front Jaw Wood Handle Furnished if Desired. Furnished with or without stop in front jaw. Faces drilled for installation of wood faces.

Vise No.	*Width of Jaw. Inches*
210A	7
215A	8
220A	20

QUICK ACTION VISE (Toles Pattern)

Has unusually effective and durable working action. Screw is 1¼" in diameter. Half nut of high quality bronze with accurately cut threads. Furnished with or without dogs in front jaw.



Vise No.	*Width of Jaw. Inches*
100	7
200	10

MACHINISTS' VISES
Unsurpassed for strength and durability

Swivel Base Machinists Vise

Stationary Base		Swivel Base	
Vise No.	*Width of Jaws Inches*	*Vise No.*	*Width of Jaws Inches*
30	3	130	3
35	3½	135	3½
40	4	140	4
45	4½	145	4½
50	5	150	5

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3 STONES—3 GRITS—ALWAYS IN BATH OF OIL

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NEW - NEW
SEBASTIAN
Cone Head Lathe

LOW COST - SAFE - DURABLE

Illustration shows 12" size of the new Cone Head Underneath Motor Drive Quick Change Lathe. Many Safety Features. Catalog sent upon request.

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RHODES 7" SHAPER

RHODES SHAPERS SLOTTERS
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Easily converted into 3½" Slotter, making two machines in one.

Available with countershaft drive, or with motor drive, using ½ H. P. motor, thus making a self-contained unit. Occupies small space. Priced low. Send for bulletin.

THE RHODES MFG. CO.
WALTHAM, MASS.

OUR SUPPLEMENT

Artistic Wrought-Iron Work—IV

C. Weiler and Karl Ufer
New York City, New York

(See Supplement No. 323)
(Continued from the January issue)

The third of this series of articles on the design and techniques used in working with wrought iron.

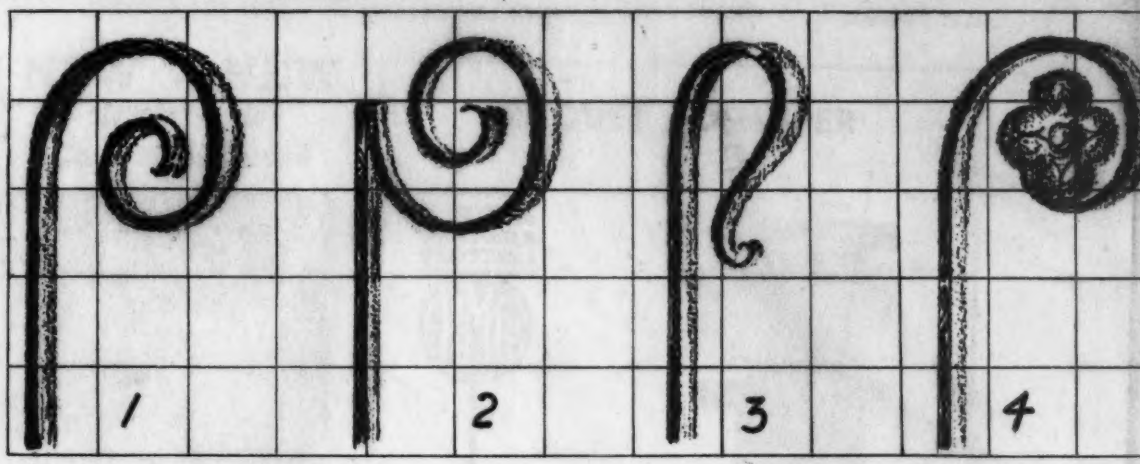
Chart IV

Sketches 1 to 8 of Chart IV are a development of scrolls and terminations together with ornamentation as applied to ends of bars. These terminations are generally used as the top ornamentation of such projects as flower stands, or at the ends of curtain rods, and the like. Much of the technical treatment having been described before, there is no necessity to repeat it here. In Figure 6, the end of the scroll should be turned to a closed loop. The ring is made of round iron, hammered slightly flat and twisted. Where hot forging is available, the ends may be tapered before flattening in order to get a more attractive effect. In Figure 7, round iron is used. It should be filed or forged to taper and then scrolled. Figure 8 is a design most generally executed by hot forging done by upsetting, spreading, and shaping. However, a creditable cold job can be done by tapering the round iron slightly, cutting the slot with the hack saw and riveting in a leaf cut from sheet iron.

We are next proceeding to the consideration of the balance of Chart IV and also Charts V and VI, for which we have selected a number of examples partly taken from work we have actually seen in schools, magazines, and books. On one side, we give the examples as we have found them, and on the other, our interpretation of what these designs might more correctly be.

The grill shown at A-1 in Chart IV is an example of very poor composition. The major motif, a sort of heart shape, is entirely too high and appears not to be on a firm foundation. There is, furthermore, too little ornament at the base, while the top is entirely too crowded. Scrolls have been used promiscuously in symmetrical manner, evidently merely to fill space without due regard to harmony. We find, thus, many lines that clash and disturb. This grille also shows strikingly the result of the use of poor techniques. We see here the ends of the scrolls cut off square, the scrolls themselves are of very poor design; notice particularly the lower part of the large scrolls at the sides, which have been squeezed to accommodate themselves to the available space. The small counter scrolls are attached with the full thickness of the iron instead of running out into

(Continued on page 38A)



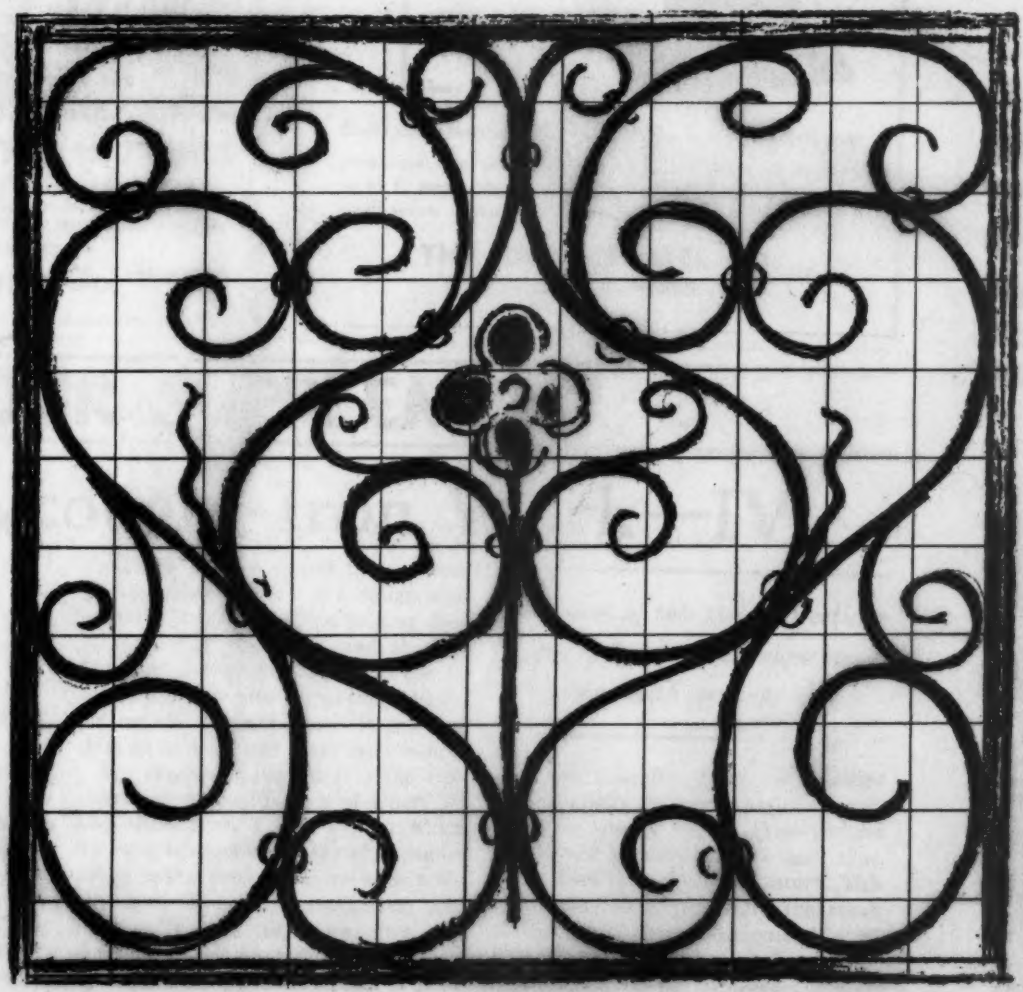


Chart IV — Artistic Wrought-Iron Work—IV, by C. Weiler and

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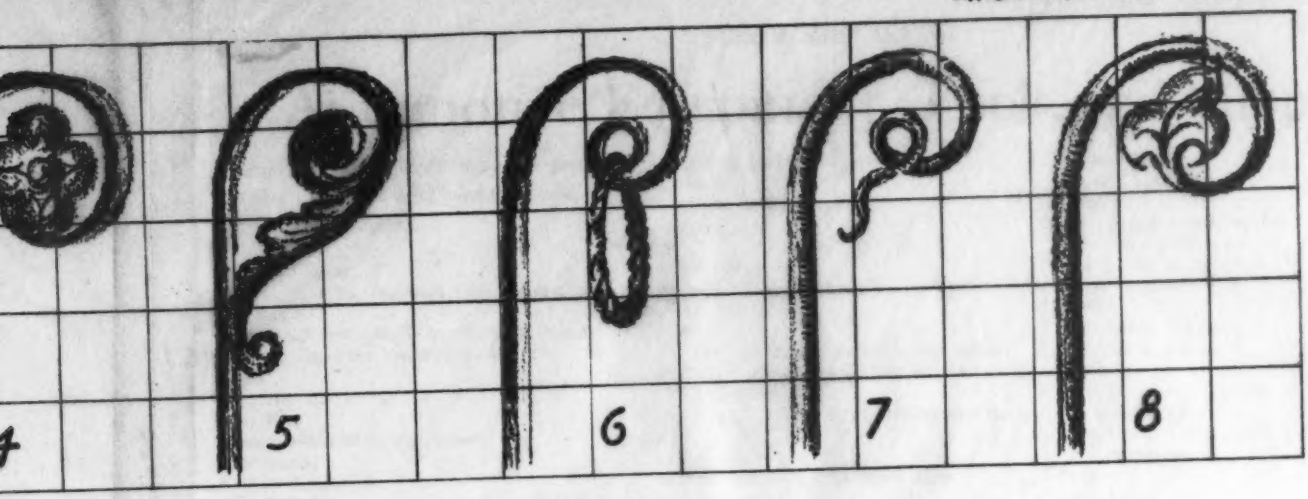
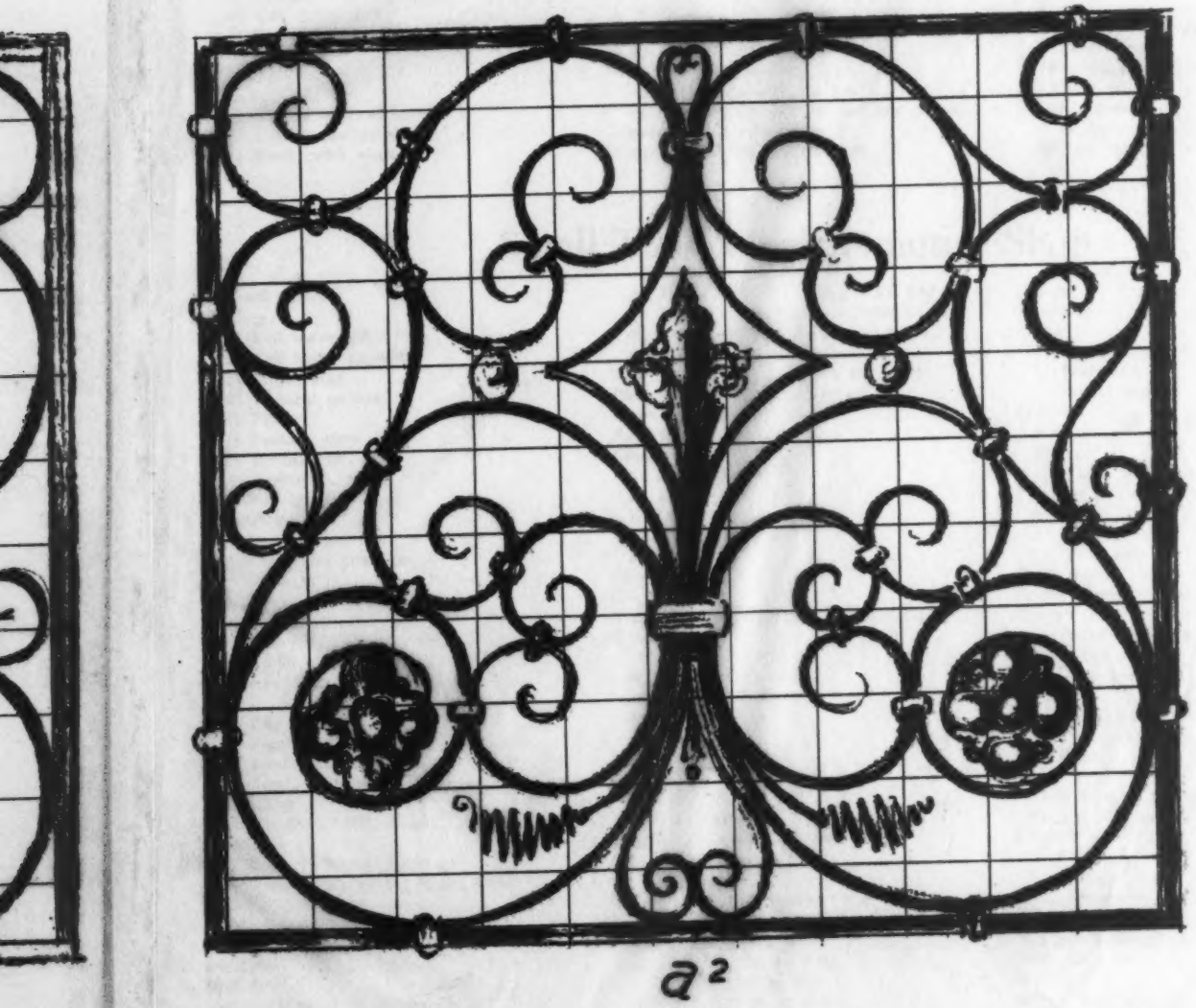




a²

IV, by C. Weller and Karl Uier, New York City. (Described elsewhere in this issue)

Automotive Equipment, Tools, and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Air Compressor
- *a*) 3 to 4 cu. ft., with tank, piping, and motor
- *b*) Small portable, 1 cu. ft., with motor

Aligning Jig — for connecting rods
Anvil
- *a*) No. 100 or No. 125
- *b*) Rim

Armature Growler and Tester
Axle Stands
Battery Equipment
- *a*) Cell tester, panel type with discharge rack
- *b*) Charger (15-battery size) with rack
- *c*) Charger (6-battery size)
- *d*) Gas stove (small)
- *e*) Lead-burning torches, with gauges and piping
- *f*) Plate racks

Bench
- *a*) Electric test, elaborate
- *b*) Electric test, simple
- *c*) Work, with vises
- *d*) Work, portable with vise

Blackboard
Blowtorches — 1-qt. size
Bookcase
Brake
- *a*) Adjusting stand
- *b*) Band-lining machine

Bulletin Board
Cabinets
- *a*) Wood or metal, for bolts and supplies
- *b*) Wood or metal, for filing job sheets and correspondence

Chain Hoist — with overhead trolley and track
Chairs
- *a*) Teacher's
- *b*) For tables, or with tablet arms

Crane — portable
Crankshaft Truing Tool
Creepers
Desk — teacher's
Drill
- *a*) Breast
- *b*) Hand
- *c*) Electric portable, ½ in.
- *d*) Electric portable, ¼ in.
- *e*) Press, 21 in., with motor and chuck

Dynamometer — electric
Forge — with blower and tools
Furnaces — gas
Grease Dispensers
Grinder
- *a*) Cylinder with motor
- *b*) 8 in., with motor
- *c*) 12 in., with motor

Hones — cylinder
Jacks
- *a*) Lever, 1½-ton
- *b*) Floor, roller

Lathe
- *a*) 11 in. x 4 ft., with motor, chucks, and attachments
- *b*) 16 in. x 6 ft., with motor, chucks, and attachments

Press
- *a*) Arbor
- *b*) 30-ton

Spray Painting Outfit
Valve Refacing Machine
Vulcanizer
- *a*) Electric steam for tube work
- *b*) Small, hand

Welding Outfit — with tanks, gauges, and cutting torch
Wheel Alignment
- *a*) Gauge
- *b*) Test table

Small Tools for Automotive Shop

Alcohol Tester
Battery
- *a*) Cell tester, prod type
- *b*) Cell tester, cadmium
- *c*) Clips, large
- *d*) Element pullers
- *e*) Fillers
- *f*) Funnels, glass
- *g*) Hydrometer, acid
- *h*) Knives
- *j*) Post builders
- *k*) Post drills
- *l*) Post markers
- *m*) Separator trimmer

Bits
- *a*) Expansive
- *b*) Ratchet brace
- *c*) Wood, 3/16 in. to 1 in.

Bolt Cutter — 24 in. and 36 in.
Calipers — 6 in. inside and outside
Cans
- *a*) Oil, 1/3-pt.
- *b*) 1-gal., gas, safety
- *c*) 5-gal., gas, safety
- *d*) 5-gal., kerosene
- *e*) Waste

Checks — tool, 1,000, blank
Chisels
- *a*) Cape, ⅜ in. and ⅝ in.
- *b*) Cold, ⅜ in., ⅝ in., ¾ in., 1 in.
- *c*) Diamond-point

Combination Squares — 12 in.
Cotter-Pin Extractor
Dividers — 6 in. and 10 in.
Drill Sets
- *a*) 1/32 in. to ½ in., by 64ths
- *b*) ½ in. to 1¼ in., by 32nds

File Cards
File Handles — assorted
Files
- *a*) Flat bastard, 6 in., 8 in., 10 in., and 12 in.
- *b*) Half round, 6 in., 8 in., 10 in., and 12 in.
- *c*) Mill, 6 in., 8 in., 10 in., and 12 in.
- *d*) Round, 6 in., 8 in., 10 in., and 12 in.
- *e*) Square, 8 in., 10 in., and 12 in.

Fire Extinguishers — Pyrene and Acid
First-Aid Cabinet and Supplies
Floor Brushes — 18 in.
Funnels — tin, assorted sizes
Gauges
- *a*) Air pressure
- *b*) Center
- *c*) Depth
- *d*) Thread
- *e*) Thickness

Glass Cutters
Goggles
Grease Guns — plain and pressure-type
Hammers
- *a*) Ball-peen, 4-oz.
- *b*) Ball-peen, 1¼-lb.
- *c*) Ball-peen, 2-lb.
- *d*) Lead
- *e*) Riveting
- *f*) Sledge, No. 12

Ladle
- *a*) 3 in. bowl
- *b*) 6 in. bowl

Lamps — extension, with reels
Lead Pot — gas
Magnet Charger
Meters — volt and ammeter test
Micrometers
- *a*) Outside, 0 to 1 in.
- *b*) Outside, 2 in. to 3 in.
- *c*) Outside, 3 in. to 4 in.
- *d*) Inside, 1½ in. to 6 in.

Molds
- *a*) Battery nut
- *b*) Battery post
- *c*) Battery strap
- *d*) Burning stick
- *e*) Lead hammer

Oilstone
Pipe Taps — ⅛ in., ¼ in., ⅜ in., and ½ in.
Pliers
- *a*) Combination, 6 in.
- *b*) Flat nose
- *c*) Round nose

Pullers
- *a*) Bearing
- *b*) Gear
- *c*) Wheel, hub type

Punches
- *a*) Center
- *b*) Taper pin
- *c*) Blacksmith

Putty Knives
Reamer — splindle bolt
Reamer Sets
- *a*) Piston pin, ½ in. to 1⅜ in.
- *b*) Taper pin
- *c*) Valve seat

Saws
- *a*) Hack, frames, 10 in., adjustable
- *b*) Hack-saw blades, 18, 20, and 24 teeth
- *c*) Hand

Scales
- *a*) Steel, 6 in., graduated 1/64 and 1/100 in.
- *b*) Steel, 12 in., graduated 1/32 in.

Scrapers
- *a*) Bearing
- *b*) Carbon

Screw Drivers
- *a*) 6 in. and 12 in.
- *b*) Small combination

Screw Extractors
Scribers
Snips — tin. 3 in. straight and 3 in., curved
Soldering Coppers — 1-, 2-, and 3-lb. with handles
Spring Spreaders
Stamps
- *a*) Figures, 3/16 in.
- *b*) Letters, 3/16 in.

SNAP-ON TOOLS, INC.

Snap-on TRADE MARK
INTERCHANGEABLE
Socket Wrenches

An organization of tool specialists maintaining a nation-wide personal tool service through permanent branch offices operated on a local tax-paying basis and managed by local residents of the community. Ceaseless experimental work has enabled us to constantly offer new and improved tools to assist mechanics and improve shop work efficiency on the rapidly-changing designs of modern automobiles.

Blue-Point TRADE MARK
Mechanic Tools

Snap-On Socket Wrenches not only are used and recommended by a large majority of auto mechanics, but they are used on the assembly lines of most of the modern car manufacturers. The line provides a full range of dependable sockets in all hexagon and square sizes at a low cost per wrench.

Blue-Point Tools are built for practical, everyday use by professional mechanics and their widespread popularity in industry is the highest possible recommendation for them. In addition to standard Boxocket, Open End, Tappet Wrenches, etc., this line covers many special tools for auto repair work.

The Student School Shop Set

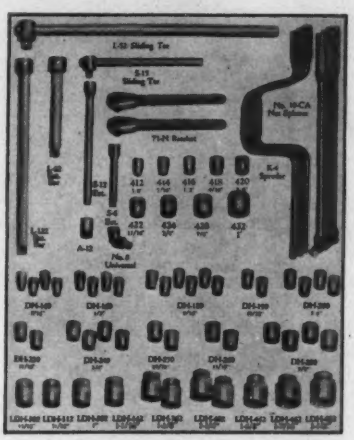
Every school pupil requires his own text book—it would be most impractical for an entire class to attempt to study in turn from two or three copies. Each student of Drafting likewise needs certain individual drawing instruments for efficient work. Similarly, it is just as important that each student in the auto mechanics shop be equipped with an individual set of the most basic and essential wrenches. This need is recognized by School Shop Instructors who have approved the Snap-On Student Set of matched units as solving an otherwise perplexing and costly problem. In many cases the student prefers to own this personal set, consisting of a combination Sliding Tee and Offset Handle, an Extension Bar and the six most needed sizes of Sockets.

8 Snap-On Wrenches as illustrated, in metal case.....$5.30
Special School Price when sold in lots of six or more sets for educational purposes only. Per Set.....$4.00

School Shop Toolroom Assortment

A popular combination of matched units carefully selected as forming the socket wrench equipment of greatest service in the average school auto mechanics shop. The seventy-one units offer an almost unlimited number of wrench combinations for every type of hook-up needed.

Units in greatest demand are duplicated according to the need, a most desirable feature where tools are checked in and out of the toolroom and the largest possible number of working combinations are wanted at one time. Please note that while we recommend this set for the average shop, we will make up special selections to suit any particular requirements.

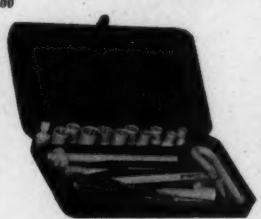


71 Snap-On Wrenches as illustrated, with total price.....$60.20
Special School Price (when sold as a set) for educational purposes only.....$45.15

Popular Snap-On and Blue-Point units needed in every shop

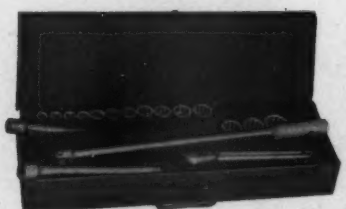
No. 80 Ferret Set

Seven Double Hexagon Sockets 3/8" to 3/4", a Reversible Ratchet Handle, Speeder Tee, Sliding Bar, Universal Joint and three Extension Bars. Extremely strong though slender units that make quick, easy work of nuts in hidden or cramped places on all modern automobiles.



No. 56 Midget Set

Eight Hexagon Sockets 3/16" to 7/16", two Square Sockets 1/4" and 5/16", Ratchet, Speeder Tee, Sliding Tee, Ext., Bar and Insulated Handle. Excellent for electrical, carburetor, radio and other small work.



No. 45 General Utility Set

Will handle the greater proportion of the average nut turning work in automotive garages. This set contains the Nut Spinner Handle (also used as a Nut Spinner and an Offset Handle), Master Ratchet, a five inch and a ten inch Extension Bar, and the SW-1500 series of Straight Walled Hexagon Sockets, including sizes 7/16" to 1 1/4". This set has been extremely popular with professional mechanics due to the wide range of socket sizes and the many handle combinations possible. It offers the school shop great utility at low cost.

Straight-Walled Sockets

SW-1500 Set of thin straight-walled double hexagon sockets, 7/16" to 1 1/4" sizes. Close quarter nut turning ability has made these sockets the popular choice of professional mechanics everywhere.

No. 71-A Reversible Ratchet

Ratchet action reverses instantly by moving a convenient thumb lever. Designed to be the strongest and most practical tool of its kind and size ever built. Twenty teeth on ratchet gear provides turning action in the closest quarters with only a slight handle movement. Wheel and pawl accurately machined from finest high-carbon alloy tool steel.

Nut Spinner Handles

Nut Spinners provide great utility. The handle pivots at any angle from the socket receiving end and has plenty of leverage for pulling the big nuts up tight. Can also be used as a tee wrench in combination with sliding bar or ratchet handle.

BPR-8 Set Blue-Point "Supremes." Five outstanding improvements:—Thinner head design—Narrower jaws for close corners—Lighter Weight—Better, tougher steel—Distinctive modern design and finish. 3/8" to 7/8" sizes.

Open End Wrenches

Brake Adjusting Wrenches

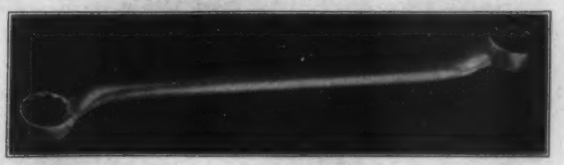
B-1352, illustrated above, is one of many wrenches we have designed expressly for brake adjusting work. This tool contains four wrench sizes 3/16", 1/4", 3/8", and 1/2", and is built for Bendix Brake Work.

Midget Ignition Open Ends

Midget size tools that make short work of those tricky ignition, carburetor jobs. Ideal for all small radio and electrical bench work. Each wrench has two different size openings. Each opening is duplicated on a twin sized wrench at a different angle. Sizes 7/32" to 7/16" inclusive.

Snap-On Tools, Inc.—Continued

Double End Boxocket Wrenches



Made in three sizes—Midget, Dwarf, and Standard—including sizes 3/16" to 1". Each end has a different wrench size and is offset to allow working space around obstructions. Boxockets combine the strength of a socket wrench with direct end wrench leverage to make the strongest type wrench made.

Angle End Boxocket Wrenches

Straight handles allow these wrenches to be used in places where the offset type handle would be awkward. The 15 degree angle of the heads provides clearance from obstructions together with a long, direct leverage.

Combination Wrenches

Designed with a boxocket and an open end wrench of the same size on each handle, and made in a long handle and a short handle series. A new type wrench all mechanics have been quick to adopt.

Curved Boxocket Wrenches

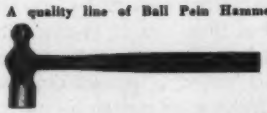
Made in three sizes to take the most generally used sizes of nuts and bolts. Two openings of the same size on each wrench, but with opposite handle curve. Gets those around-the-corner nuts.

Blue-Point "Supreme" Chisels and Punches

Professional use demands a chisel that will cut bolts, cast iron and steel without damage to the cutting edge, yet tough enough for use as a wedge or lever. Blue-Point "Supreme" Steel contains these and other properties not found in other makes of Chisels or Punches. Above all, the danger of flying chips is entirely eliminated. See catalog for various types and sizes.

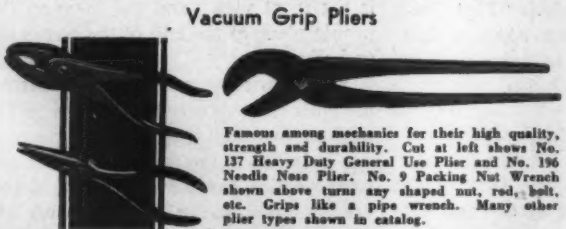
Hammers and Screw Drivers

A quality line of Ball Pein Hammers, correctly designed and balanced, with handles of selected seasoned hickory. Heads securely anchored. Made in 12 sizes.



Blue-Point "Pyralin" Screw Driver shown is one of the most popular units. Blade designed to withstand hardest service — handles insulated composition. See catalog for descriptions of this and other types.

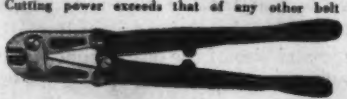
Vacuum Grip Pliers



Famous among mechanics for their high quality, strength and durability. Cut at left shows No. 137 Heavy Duty General Use Plier and No. 196 Needle Nose Plier. No. 9 Packing Nut Wrench shown above turns any shaped nut, rod, bolt, etc. Grips like a pipe wrench. Many other plier types shown in catalog.

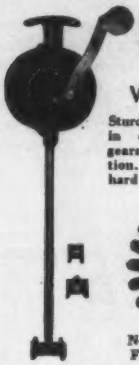
Bolt Cutter and Nut Splitter

Cutting power exceeds that of any other bolt cutter of similar size on the market. Handles hammer forged—will not bend or snap. Four types of Cutting Blades and a Nut Splitter Blade interchangeable on one handle.



Ford, Chevy and Buick Tools

Special purpose tools designed to simplify difficult jobs on these cars are too numerous to describe here — write for catalog.



Valve Grinder

Sturdily built and smooth in operation. Machined gears. Rapid oscillating motion. A real tool for long hard service.

No. 310 Feeler Gauge
Finest Swedish Steel

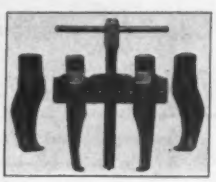
Stronger, slim adjustable jaws for all types of motors. Cam lock holds spring compressed. Easy to use—simple to adjust.

High Speed Drills

Constructed so as to show the best all-round performance in all classes of work. They are, therefore, ideal for general requirements of the school auto shop. Sizes run from 1/16" to 1/2".

Clutch Aligning Tool

Holds the disc in position while the compressor is being bolted into position. Nine sizes of bearing pilots adapt this tool to practically every make of car or truck. A big time saver on this job.

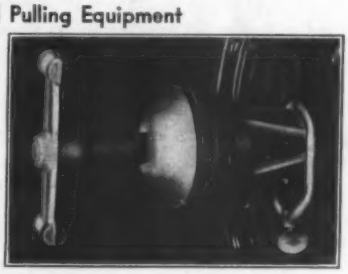


Gear and Bushing Pulling Equipment

The Gear Puller illustrated is intended for light gear pulling work of all kinds. We also make heavy duty pullers, universal puller tools, bearing race, and axle bearing pullers. In short, a puller for every possible type of job. See our new catalogue.

Wheel Pulling Equipment

The Blue Point Wheel Puller tool using interchangeable legs will service all passenger cars and light trucks using demountable wheel hubs. Illustration shows the tool in use on 1936 V-8 Ford. Write for special Wheel Puller Folder which fully describes this money saving tool. One puller is all that is necessary.



Write for this New Catalog

Space here only allows us to show a small number of the standard and some of the special tools in the Snap-On and Blue-Point lines. There are literally hundreds of other dependable, high quality units, just as important, illustrated and fully described in our regular catalog, a copy of which we are anxious to send you together with detailed Budgets. It places you under no obligation and we suggest you write for them immediately.

Genuine Snap-On Wrenches and Blue-Point Tools can be purchased only through our own Sales Branches listed. Advise your Purchasing Department accordingly.

Albany, N. Y..... 102 Quail St.
Atlanta, Ga..... 10 North Ave., N.W.,
Baltimore, Md.....2407 Greenmount Ave.
Boston, Mass..... 510 Cambridge St., Allston Dist.
Brooklyn, N. Y.....1649 Bedford Ave.
Buffalo, N. Y..... 19 E. Utica St.
Chicago, Ill..... 2025 MichiganBlvd.
Cincinnati, Ohio.....1120 Race St.
Cleveland, Ohio.....2438 Euclid Ave.
Columbus, Ohio..... 107 N. Monroe Ave.
Dallas, Texas.....2809-11 Main St.
Denver, Colo..... 17 E. Fourth Ave.
Detroit, Mich.....4450 John "R" St.

Indianapolis, Ind..... 933 N. Illinois St.
Jacksonville, Fla..... 119 W. Ashley St.
Kansas City, Mo.....2516 Grand Ave.
Los Angeles, Calif....1845 S. Flower St.
Milwaukee, Wis.....2417 W. State St.
Minneapolis, Minn....1218 Harmon Place
Montreal, Que.....1008 La Gauchetiere St., W.
Newark, N. J..... 429 Central Ave.
New Orleans, La..... 940 Poydras St.
New York, N. Y..... 7 Lenox Ave.
Omaha, Neb.....2041 Harney St.
Philadelphia, Pa.....1705 Fairmount Ave.
Pittsburgh, Pa.....7007 Kelly St.

Richmond, Va..... 606 W. Broad St.
San Francisco, Calif.. 276 Golden Gate Ave.
Seattle, Wash..... 110 Broadway, N.
St. Louis, Mo.....2647 Washington Blvd.
Syracuse, N. Y..... 111 W. Taylor St.
Toledo, Ohio.....1012 Jackson St.
Toronto, Ont..... 504½ Church St.
Vancouver, B. C.....1152 Howe St.
Winnipeg, Manit..... 80 Lombard St.

Export Department, Snap-On Tools, Inc.,
59-61 Pearl St., New York, N. Y.

SNAP-ON TOOLS, INC. - -

Factory and Main Office
KENOSHA, WISCONSIN

(Continued from page 35A)

Tap-and-Die Sets
- *a*) Machine screw
- *b*) S.A.E. ¼ in. to 1 in.
- *c*) U.S.S. ¼ in. to 1 in.

Tire Tools
Tool Kit — metal box or canvas roll, empty
Twist Drills — (extra sets) selected sizes
Valve
- *a*) Grinders (hand)
- *b*) Spring lifters

Wrenches
- *a*) 8 in., 10 in., 12 in., and 18 in.
- *b*) Ignition sets
- *c*) Pipe, 10 in., 14 in., 16 in., and 18 in.
- *d*) Rim socket
- *e*) Socket sets, large assortment with case
- *f*) Spark plug
- *g*) Speed wrenches
- *h*) Standard end sets, ¼ in. to ⅞ in., U.S.S. and S.A.E.
- *j*) Valve-tappet wrenches

Supplies

Acetylene Gas — in drums, for welding
Acid
Alcohol
Babbitt
Bearing Blue
Bearing Compound
Bolts
- *a*) Machine, selected sizes
- *b*) S.A.E., selected sizes
- *c*) Stove, flat or round heads, selected sizes

Brake Juice — ½-pt. cans
Brushes
- *a*) Paint
- *b*) Spark-plug
- *c*) Spoke
- *d*) Steel
- *e*) Varnish

Chamois
Coil-Spring Assortment
Copper Tubing
Cotter Pins — assorted sizes
Crocus Cloth
Distilled Water
Drain Cocks
Electrolyte
Emery Cloth — Nos. 00, 0, ½, and 1
Enamel — Auto Painting
Gaskets
- *a*) Copper asbestos
- *b*) Cork and felt
- *c*) Flange

Gasoline
Grease — cup, cans
Kerosene
Keys, Whitney — assorted
Lacquer — colors
Lead
Lubricant — transmission
Nails and Brads
Nuts
- *a*) S.A.E., castellated, square, hexagon, selected sizes and kinds
- *b*) U.S.S., square and hexagon, selected sizes
- *c*) Machine-screw, selected sizes
- *d*) Wing, selected sizes

Oil
- *a*) Cylinder, light, medium, and heavy
- *b*) 600W
- *c*) Penetrating

Oxygen — in drums for lead burning
Pig Lead
Piston-Ring Compressors
Radiator Hose
Rivets — brake-lining, 5/16 in., ½ in., and ¾ in. long
Sandpaper — Nos. 00, 0, ½ and 1
Screws
- *a*) Flat-head or round-head, iron or brass, selected sizes and kinds
- *b*) Cap and machine, iron or brass, selected sizes and kinds

Sealing Compound
Shellac — ½-pt. cans
Shim Stock
Soapstone
Solder — bar, wire, or self-fluxing wire
Soldering Paste
Spelter — for brazing
Sponges — ½-lb.
Starting Cable
Tacks and Staples — upholstery
Tire
- *a*) Carcass fabric
- *b*) Cushion stock
- *c*) Inner-tube repair stock
- *d*) Patching cement
- *e*) Patches
- *f*) Putty
- *g*) Tread stock
- *h*) Vulcanizing

Valve-Grinding Compound — coarse and fine
Washers
- *a*) Lock, assorted sizes
- *b*) Wrought-iron

Waste
Wire — primary and secondary

(Continued from page 34A)

featheredge. While some of the scrolls are appropriately joined with round-headed rivets, it might have been decidedly better to apply these rivets also in those places where the scrolls appear to be unjoined.

Our suggestion is given at A-2 on Chart IV. It shows a design built on a firm foundation which works itself up logically to a central focal point of diamond shape. The greater solidity is at the base, while at the very top there is more airiness. The scrolls are all well proportioned in themselves, and they are artistically joined with tie bands or clips. Notice particularly the utilization of the two ball spacers on each side of the diamond. Their use is very rarely considered, although in themselves they make very fine ornamentations and in this particular instance fill a space which otherwise would have been disturbing. If, on the other hand, the scrolls had been made to meet at these points, they would have been pulled out of proper shape, and the division of space in relation to the diamond. The major motif would have been decidedly ugly. Notice, also, where small scrolls are joined to the larger units, they run out into a featheredge and therefore grow in a natural manner from the main stem. The ends of the scrolls are neatly tapered and slightly peened to graceful termination.

THAT CONFUSING "SIDE VIEW" AGAIN

F. R. Kepler, Supervisor of Mechanical Drawing, Detroit, Michigan

In commenting on the article "That Confusing 'Side View'" which appeared last month in this magazine, the writer suggests a generally acceptable solution.

The comments under the title "That Confusing 'Side View'" in the January issue of this magazine are very much to the point. The writer agrees, and has for some time, with the terminology suggested; namely, top view, front view, and end view. This terminology largely conforms with shop usage and is especially helpful in beginning drawing courses.

Further, these are perfectly logical terms if a given object is assumed to be so located with respect to the planes of protection that the object is below the horizonal plane and behind the vertical plane of projection; that is, in the third angle. A profile plane may be assumed either at the right or at the left or both at the right and at the left of the object. This arrangement of the planes of projection often is represented by screens so hinged that three planes at mutually right angles form three surfaces of what commonly is called a projection box. Obviously the view or projection on the horizontal plane, or top of the projection box, is the top view; the view on the vertical plane, or front of the box, is the front view; and the view on the profile plane at the end of the box is the end view.

For drawing purposes, good practice assumes that an object is placed in the position in which it naturally appears in use or in which the principal tool operations require. Further, the principal axes are assumed to be parallel with the planes of projection. Therefore it is conceivable that the top view may furnish the most information regarding the shape and size of the object and "be the most important and the most complicated." This may be true regarding the front view and even the end view. The views are given the names they are, not because of their importance or complication, but because of the views resulting from their projection on the respective planes of projection.

See French, *Engineering Drawing*, Fourth Edition, p. 86 (McGraw-Hill); also Kepler, *Mechanical Drafting Handbook*, p. 43 (Bruce).

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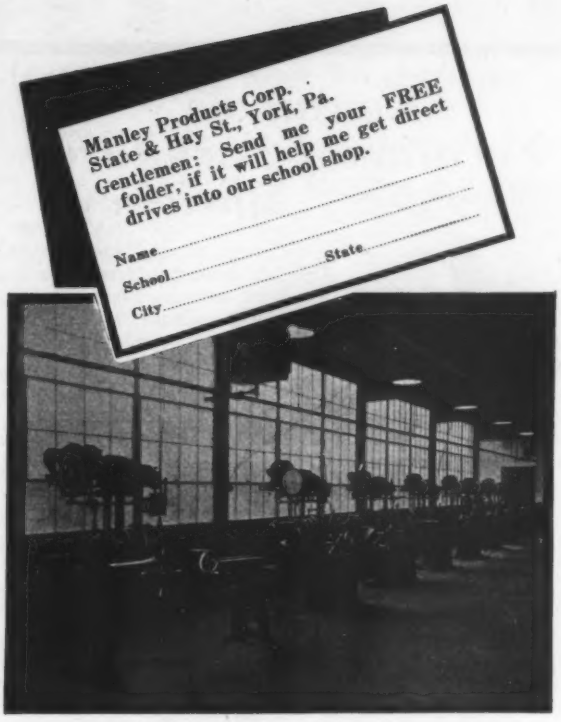
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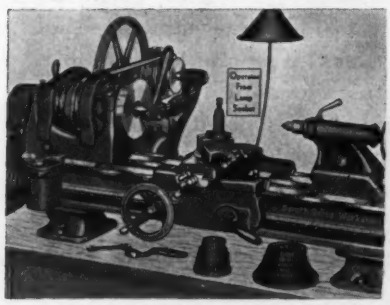
School-Shop Equipment News

V-BELT DRIVE ON 1936 9-IN. "WORKSHOP" LATHE

The South Bend Lathe Works, South Bend, Ind., has announced that the new V-belt drive is now optional on the 1936 Model 9-in. "workshop" precision lathe in place of the standard flat-belt drive.



The lathe has a four-step cone headstock, with a single V-belt drive from the countershaft. This provides eight spindle speeds, four on the open belt, and four in the back gear. The speeds range from 44 to 585 r.p.m.

The countershaft also is equipped with a four-step, V-pulley and an adjustment which slackens or tightens the belt tension to permit a shifting of the belt from step to step on the cone pulley. This new improvement gives the lathe an abundance of extra power to work with the toughest and heaviest of metals.

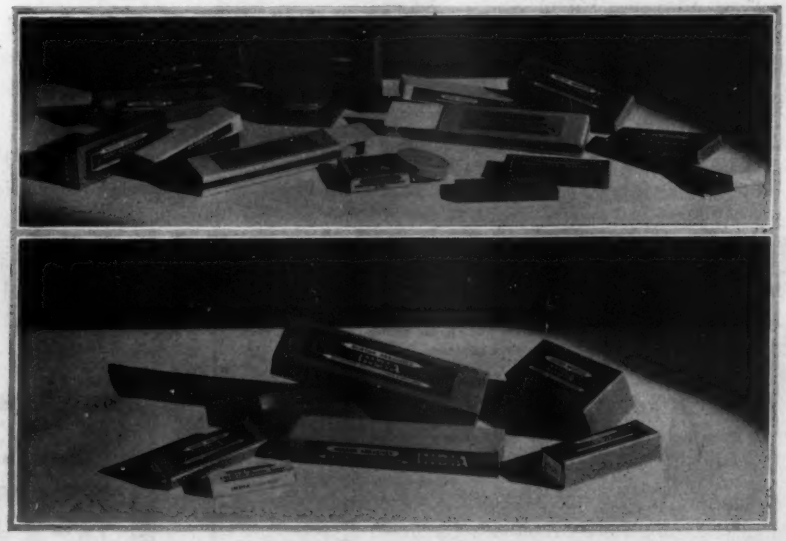
In addition to the V-belt drive, the 1936 Model 9-in. workshop lathe features ten new improvements, including the new twin-gear reverse for right- and left-hand threads and feeds, a ball-thrust bearing on the headstock spindle, larger spindle bearings, etc. The strong and rigid bed is cast of 50 per cent steel and 50 per cent nickle iron. The lathe undergoes 64 major tests to bring all alignments to within .001 in. There is a choice of four bed lengths of 3 ft., 3½ ft., 4 ft., and 4½ ft.

The convenient size, its adaptability due to the attachments which are available, and its low price, make this metalworking lathe an ideal addition in the shop. Additional information may be secured from the firm's technical service department.

NORTON PRODUCTS IN NEW PACKAGES

Oilstone and abrasive specialties marketed for more than 100 years under the name of

(Continued on page 43A)

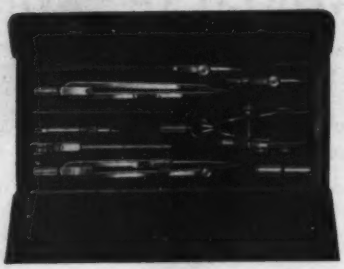


Noted products in new packages

POST'S

Complete Line of Drafting Instruments and Materials

A set from the "Junior Line"



Set No. 91143

No. 91143 — This sturdy, accurate set is being used by many student draftsmen. It consists of a 4¾" ruling pen, 3¼" combination bow pen and pencil; 4¾" plain divider; 4¾" compass and divider part, pencil part, pen part and lengthening bar. The instruments are attractively cased in a velvet lined pocket book style container. List price $3.60 less substantial discount to educational institutions.

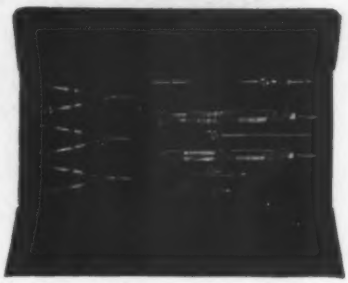
See catalog for complete sets. List prices ranging from $2.00 upward.

No. 91112 — Complete with velvet lined Pocket book style case, one each 4½" and 5½" ruling pens with releases, 3½" bow divider, 3½" bow pencil, 3½" bow pen, 5½" Hairspring divider, 5½" compass with jointed legs, pen part, lengthening bar and straightening device, List price $7.50, *less substantial discount to Educational Institutions.*

List price $3.60 *less substantial discount to Educational Institutions.*

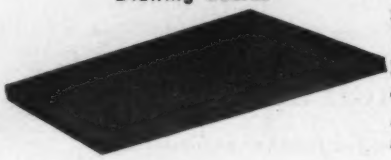
See catalog for complete sets. List prices ranging upward from $1.40 list.

A set from the "Student Line"



Set No. 91112

Drawing Boards



No. 97251—Basswood, ¾" thick; shellacked, has two drawing surfaces.

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Size	12 x 17	16 x 21	18 x 24	20 x 24½	20 x 26	23 x 31
List price each	.62	.92	1.14	1.22	1.30	1.80

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Triangular Boxwood Scales

No. 97301—Made of best grade seasoned boxwood; machine divided, guaranteed accuracy, divided 1/8, 3/32, 1/16, 1/8, 1/4, 3/8, 1/2, 3/4, 1, 1½, and 3" to a foot—List price each $.50. Same scale maplewood, List price $.42 each.

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No. 97746-B — No. 97884 — style 10 — 13 — 17

Made of good transparent high grade celluloid.

Triangles		6"	8"	10"
No. 97746-A—30 x 60 degree	List Dozen		3.40	4.75
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No. 97884	Style	6	13	17
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	1 quart	6.80

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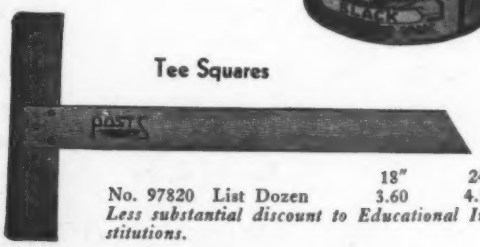

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	Emerald Green	

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Drafting Equipment and Supplies

These maximum lists may be found helpful in checking inventories or preparing budgets.

Adjustable-Curve Ruler
Beam Compass
Bench Brushes
Blackboard
- *a*) Permanent or portable
- *b*) Compass, 15 in., with locking device
- *c*) Drawing set: T square, straightedge, triangle, and protractor

Blueprint
- *a*) Frame or machine
- *b*) Washing trays or washer
- *c*) Paper tube, air-tight
- *d*) Drying rack or dryer

Bookcase
Cabinet
- *a*) For filing drawings
- *b*) For storing drawing boards
- *c*) For storing drawing instruments
- *d*) For storing models

Calipers — 6 in. and 8 in., inside and outside
Chair — teacher's
Desk — teacher's
Dividers — proportional
Drafting machine — and accessories
Draftsman's Steel Protractor
Drawing Boards — large
Drawing-Board Supports — to be set on or attached to woodworker's bench
Drawing Tables and Stools
- *a*) For Students
- *b*) For Teachers

Ink-Bottle Holder
Irregular Curves — Nos. 17, 21 and 24, wood, rubber, or transparent
Lettering Angles
Lettering Pens — assortment of 12
Level or Transit — builders' for architectural students
Leveling Rod — for use with the transit
Machinists' Combination Set — 12 in.
Marking Pins — for use with measuring tape, for architectural students
Micrometer — 1 in., for mechanical-drafting students
Oilstone — 3 in. case
Pantograph — 21 in.
Parallel Rules
Planimeters
Plumb Bob
Shears — for trimming blueprints and drawings
Speed Counter — for mechanical-drafting students
Steel Scales — 12 in.
Stop Watch — for mechanical-drafting students
Table
- *a*) For cutting and trimming drawings and blueprints
- *b*) For disassembling and reassembling machine parts and models

Tapeline
- *a*) 100 ft. steel, for architectural students
- *b*) 50 ft., steel or metallic

Tool Box — containing 1 machinists' hammer, one 6 in. adjustable wrench, one 6 in. screw driver, one 6 in. combination pliers
Triangles
- *a*) 30–60-deg. 14 in. transparent
- *b*) 45-deg. 10 in. transparent

Triangular Scales — civil engineers' type, 12 in.
T Square — adjustable or fixed head, for large drawing board or straightedge with parallel rule attachment for large drawing boards
Wall Charts — lettering, decimal equivalents, etc.
Yardstick

Drafting—Small Equipment

To be provided by, or for, each student

Drafting — Small Equipment
To be provided by, or for, each student
Drawing Board — size to be specified by instructor
Drawing Instruments — as specified by instructor
Erasing Shield
Irregular Curve — Nos. 8 and 13, transparent
Pencil Compass
Penholder — for lettering pens
Pens — assorted, for lettering
Protractor — not over 5 in.
Scale — 12 in. architects', triangular
Scale Guard
Slide Rule — 10 in., as specified by instructor
T Square — to fit drawing board
Triangles — 30–60-deg., 10 in. transparent, and 45-deg., 8 in. transparent

Drafting Supplies

Bichromate of Potash — crystals
Blueprint
- *a*) Paper, 36 in. wide
- *b*) Writing fluid

Paper
- *a*) Cross-section, 8½ in. x 11 in.
- *b*) Detail, 24 in. x 36 in.
- *c*) Drawing, 24 in. x 36 in.
- *d*) Isometric, 7 in. x 10 in.
- *e*) Tracing, 36 in.

Powder — for tracing cloth
Tracing cloth — 36 in.
Van Dyke
- *a*) Fixing salts
- *b*) Paper, 36 in.
- *c*) Writing fluid

Drafting—Additional Supplies

To be provided by, or for, each student

To be provided by, or for, each student
Erasers
- *a*) Cleaning
- *b*) Ink
- *c*) Pencil

Ink
- *a*) Black, waterproof
- *b*) Colored, if required

Pencils — drawing, HB, 2H, 3H, 4H, and 6H
Pencil Pointer Pad
Thumbtacks

(Continued from page 40A)

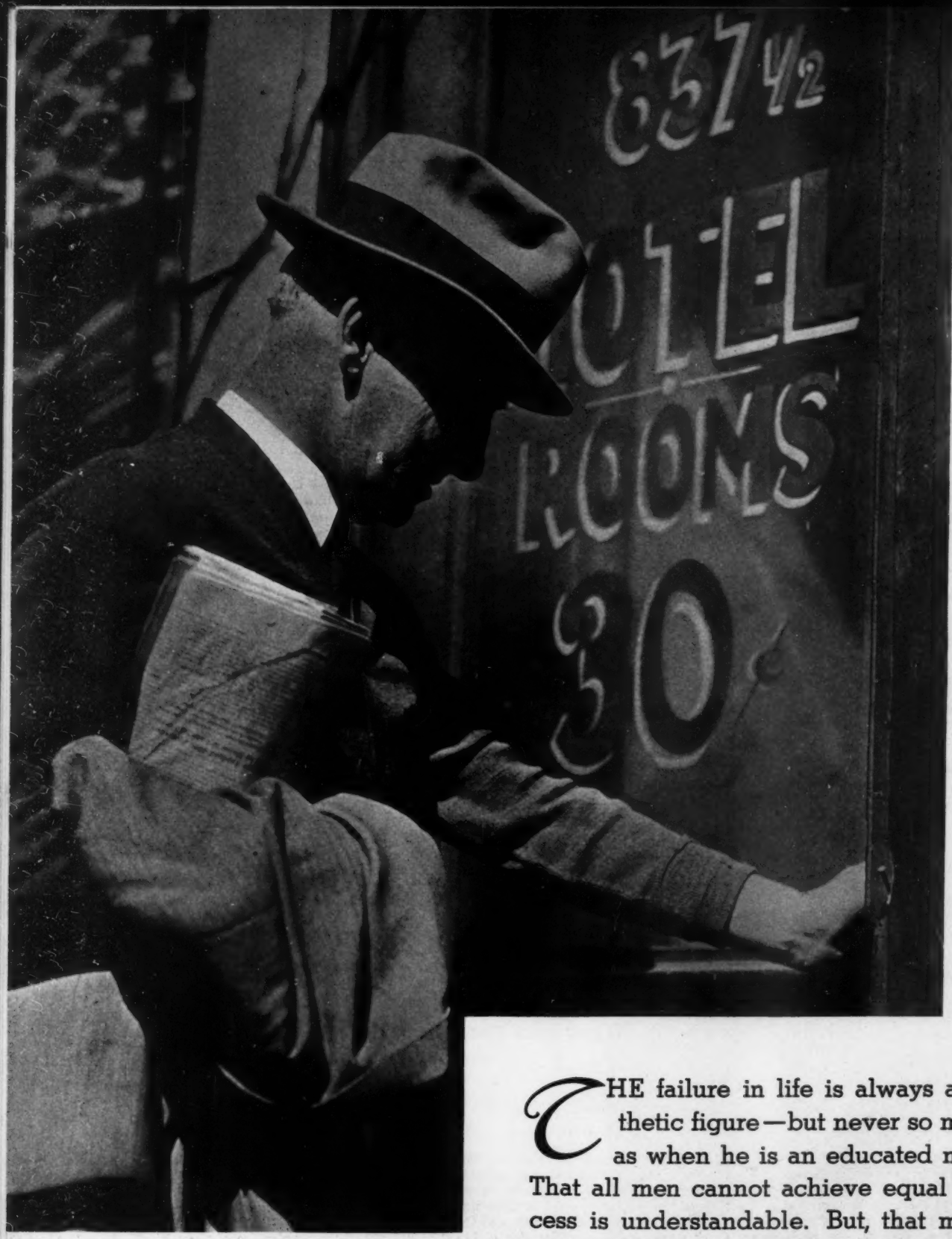
Pike Manufacturing Company, and more recently under the name of Norton Pike Company, now go to the trade in new dress.

Distributed by Behr-Manning Corporation at Troy, the New York division of Norton Company, Worcester, Mass., these specialties are packed and labeled in a very modern and interesting manner. While there is a general uniformity in the label and box designs for the various products through the general title, Norton Abrasives, a distinct color or color combination has been applied to each brand. For example, India Oilstone packages are labeled in brown; Arkansas, green; Lily White Washita, blue; while Crystolon products such as bench stones, round edge slips (new additions to the line), ax stones, Red Head Utility Files and others such as Quickcut and Queer Creek stones are in a combination of bright red and gray.

In this manner, Norton Company has modernized packages and labels of a large line of products which had its beginning when Isaac Pike, in 1823, began bartering to neighboring farmers, scythestones cut out from rock quarried in the shadow of the White Mountains.

STARRETT COMPANY ACQUIRES "LAST WORD" INDICATOR

The L. S. Starrett Company, Athol, Mass., recently acquired the business of the Henry A. Lowe Company of Cleveland, Ohio, manufacturers of the popular line of "Last Word" indicators. All of the equipment for the manufacture of these instruments has been moved to the Starrett works in Athol. The acquisition of the "Last Word" indicators helps to round out the already broad line of Starrett dial indicators now used for countless precision measuring and inspecting operations throughout the metal-working industries.



. . . that many men with high school, even college training must suffer the heartaches and poverty of downright failure is a terrible fact.

THE failure in life is always a pathetic figure—but never so much as when he is an educated man. That all men cannot achieve equal success is understandable. But, that many men with high school, even college training, and obvious ability, must suffer the heartaches and poverty of downright failure is a terrible fact.

What makes a failure is seldom any easier to discern than the secret of a

TRAGEDY *of* INDIFFERENCE

success. Sociologists have revealed, however, that a large proportion of the failures among trained men can be definitely traced to one common weakness . . . faulty viewpoint. "Educated" failures are men who have been trained how-to-do . . . but who have never learned *how-to-think.*

Whether the lads in school today become draftsmen, doctors, salesmen or mechanics in the world of tomorrow, how they think will count as much as what they know. If they do not learn to distinguish between the good and the shoddy—if they do not gain a love and respect for true craftsmanship—they can grow to be nothing more than *indifferent* men. To be devoid of ideals is to be devoid of aims, faulty in judgment, insincere in application . . . failures in the future.

Every true educator recognizes this and sees in each boy's drawing set something far more than mere equipment for today's work. Drawing instruments are usually the first fine tools to come into the hands of men-to-be. Only when the instructor shows genuine concern in their quality, workmanship, accuracy . . . *in the maker's name* . . . can he instill into his pupils the right attitude toward craftsmanship and its fruits. It is a golden opportunity to mold character—to build better men for a better world.

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Electrical-Shop Equipment, Supplies, and Motor and Testing Equipment

These maximum lists may be found helpful in checking inventories or preparing budgets.

Teachers and supervisors may find these maximum lists helpful in checking their inventories or preparing their budgets

Bench Grinder

Benches — plain or with drawers, for tools and equipment, or with compartments for the storing of wiring panels. Preferably tney should have electrical outlets

Bits
- *a*) Auger, ¼ in. to 1 in. by 16ths
- *b*) Auger, 11/16 in., 18 in. long
- *c*) Drill, for wood, square shank, ⅛ in. to ½ in., by 16ths
- *d*) Expansion
- *e*) Extension, 18 in.
- *f*) Screw-driver, ¼ in.

Blackboard — permanent or portable

Blowtorches — 1 qt. size

Bookcase

Braces — ratchet-type, 8 in. swing

Bulletin Board

Cabinets — wood or metal, for filing class records, instruction sheets, drawings, etc.

Chairs — teacher's and tablet-arm

Compass Saw

Coil
- *a*) Spreader
- *b*) Taper
- *c*) Winder

Desk — teacher's, with drawer compartments

Drill
- *a*) Breast
- *b*) Concrete, ⅜ in., ½ in., ¾ in., 1 in.
- *c*) Hand
- *d*) Portable, electric
- *e*) Twist, 1/32 in. to ⅜ in. by 32nds

Drill Press
- *a*) Bench, hand or power driven
- *b*) Heavy, power driven

Files

First-Aid Cabinet and Supplies

Hack Saw
- *a*) Blades, 10 in., 24-tooth
- *b*) Frames, adjustable

Hammers
- *a*) Claw, 12-oz.
- *b*) Machinists', ball-peen

Hickey — ½ in. and ¾ in.

Lathe
- *a*) Engine, 10 in. or 12 in. swing, 6 ft. or 8 ft. long
- *b*) Speed

Pliers
- *a*) Gas, 6½ in. and 8 in.
- *b*) Side-cutting, 6 in.

Punches — assorted

Punch — for metal molding

Reamers
- *a*) Pipe burring, ¼ in. to 1 in.
- *b*) Pipe burring, ½ in. to 2 in.

Rules
- *a*) 48 in. zigzag
- *b*) 72 in. zigzag

Screw Drivers — 3 in., 5 in., and 8 in.

Shears — for cutting metal molding

Soldering Coppers
- *a*) Assorted
- *b*) Electric
- *c*) Handles

Solder Dippers

Stocks and Dies — for pipe threads, ½ in. to 1 in.

Vises
- *a*) Machinists', 4 in.
- *b*) Pipe

Wrenches
- *a*) Adjustable, 6 in. and 8 in.
- *b*) Pipe, 10 in., 12 in., and 14 in.
- *c*) Socket, combination

Electrical Shop—Supplies

Armored Cable
- *a*) 2-wire, No. 14, single-strip
- *b*) 3-wire, No. 14, single-strip
- *c*) Box connectors

Attachment Plug

Battery Acid — 1.300

Batteries — dry cells

Battery Sealing Compound

Bar Hangers

Box Cleats

Brads — ¾ in., No. 19, and 1½ in., No. 16

Brake Lining — ¼ in. x 2 in.

Brushes — carbon, for motors and generators

Burglar Contacts
- *a*) Open-circuit
- *b*) Closed-circuit

Bushings
- *a*) Loom, No. 1 and No. 2
- *b*) "Jiffy" loom No. 2

Buzzers

Cleats — unglazed porcelain, 2-wire

Clips — test, with insulators, Universal, Nos. 22, 23, 24 and 25

Commutator Cement

Conduit
- *a*) Bushings, ½ in., ¾ in., and 1 in.
- *b*) Box connectors, for flexible
- *c*) Couplings, for flexible
- *d*) Lock nuts, ½ in., ¾ in., and 1 in.
- *e*) Rigid, ½ in., ¾ in., and 1 in.

Condulet
- *a*) Fillings, ½ in., LL, LR, and LB
- *b*) Covers, ½ in., blank

Door Openers — mortised

Emery Cloth — 1½ in. wide

Fixtures — brass-chain, suspension

Fixture Studs

Fish Paper — .0125 in. thick

Fuses
- *a*) Plug-type, renewable, 125-volt, 15 amp.
- *b*) Cartridge-type, renewable, 125-volt, 30 amp.
- *c*) Renewals for plug fuses
- *d*) Renewals for cartridge fuses

Ground Clamps — ⅜ in. to 1 in., assorted

Hickey Grips — ½ in. and ¾ in.

Lamps
- *a*) Carbon, 220-volt, 60-watt
- *b*) Mazda, selected as wattages and voltages
- *c*) Guards for brass sockets

Leather Nail Heads

Lugs — 25- and 50-amp.

Lumber — 2 in. x 4 in. x 14 ft., No. 1, white pine dressed 4 sides

Molding
- *a*) Metal
- *b*) Metal, fittings — crosses, tees, internal elbows, junction boxes, switch bases, keyless receptacles, snap switches
- *c*) Wood, 2-wire, with capping
- *d*) Wood, 3-wire, with capping

Nails — roofing

Nuts — iron, 4–36, 6–32, 8–32, 10–24, 12–24, 10–32, 14–20

Outlet Boxes — 4 in. square, with one round blank cover, and one cover with bushed opening

Pipe Straps — galvanized, ⅜ in., ½ in., ¾ in., and 1 in.

Push Buttons
- *a*) Return-call, 3-point
- *b*) Single

Receptacles
- *a*) Flush, duplex
- *b*) Porcelain-cleat, 660-watt, 250-volt
- *c*) Concealed
- *d*) Covers

Resistance Units — 125-ohm

Rosettes — wood

Screws
- *a*) Anchors, 8/32, 10/24, 12/24, 14/20
- *b*) Machine, round-head, 4–36 x ¼ in., 6–32 x ½ in., 6–32 x ¾ in., 8–32 x ⅜ in., 8–32 x ½ in., 8–32 x 1 in., 10–32 x ⅜ in., 10–24 x ⅜ in., 10–24 x ¾ in., 10–32 x ¾ in., 12–24 x 1 in.
- *c*) Machine, brass, round-head, 4–36 x ¼ in., 6–32 x ½ in., 6–32 x ¾ in., 8–32 x ½ in.
- *d*) Wood, flat-head bright, No. 5 x ¾ in., No. 8 x ½ in., No. 8 x ¾ in., No. 8 x 1 in., No. 7 x 1½, No. 8 x 1½ in., No. 7 x 2
- *e*) Wood, round-head blued, No. 7 x 1 in., No. 8 x 1½ in., No. 10 x 1½ in., No. 7 x 2

Sleeving — No. 1, white; No. 1, blue; and No. 1, red

Sockets
- *a*) Brushed brass-pull-chain, keyless, key
- *b*) Porcelain, keyless, with caps
- *c*) Porcelain, key, with caps

Socket Caps — ¼ in. and ⅜ in. bushed

Solder Wire — 50/50, size No. 10

Soldering Paste — 2-oz. cans, noncorrosive

Soldering Salts — 1 oz. cans, noncorrosive

Split Knobs — porcelain

Switch
- *a*) Battery, 4-point
- *b*) Bases, porcelain, for 10-amp. switches
- *c*) Boxes, 2¾ in. deep
- *d*) Entrance, safety, 2-pole, 30-amp., with 2-branch lighting circuits
- *e*) Entrance, safety, 3-pole, 30-amp., 250-volt
- *f*) Flush, push-button, S.P., D.P., 3-way, 4-way
- *g*) Surface, S1, S3, and S4
- *h*) Knife, type A, D.P.S.T., D.P.D.T., S.P.S.T., and S.P.D.T.
- *j*) Surface, snap, electrolier
- *k*) Surface, snap, S.P.D.P., 3-way, 4-way

Tacks — double-pointed No. 10

Tape
- *a*) Friction, ½-lb. rolls
- *b*) Rubber, ½-lb. rolls

Tubes — porcelain, 5/16 in. x 3 in., 5/16 in. x 5 in., and 5/16 in. x 10 in.

(Continued on page 48A)

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The General Electric Company is deeply interested in education, as it recognizes that the future welfare of industry, and of the country as a whole, depends upon how well the students of today are trained for the work of tomorrow. It is the policy of the Company to aid the faculty and students of our schools and colleges in every way possible. To this end, Company publications, motion-picture films, illustrated lectures, etc., are made generally available without charge.

General Electric engineers will be glad to recommend apparatus to meet your special conditions if you will give them details such as: Type of course, number of students, laboratory or shop space available, money at hand for equipment, etc. Further than this, liberal discounts from the regular commercial prices of Company products are allowed to educational institutions. For quotations on apparatus and further information concerning G-E educational service, consult the Educational Specialist at the nearest office of the Company.

Illustrated Lecture Service

General Electric Motion Pictures are available without charge to educational institutions. They are particularly valuable to schools and colleges, as they enable the student and teacher to keep informed on all important developments in the electrical field.

Complete information on this service is available in publication GES-402C.

In general the General Electric Company recommends standard apparatus for laboratory instruction. It is recognized, however, that because of its size, cost, and the power required for operation, much commercial apparatus cannot be used in the laboratories of engineering schools and colleges. For this reason, the General Electric Company has given especial attention to the selection for educational use of such standard apparatus as is of suitable size and which will illustrate fundamental principles of design and construction as well as acceptable commercial practice.

Where standard apparatus is not suitable, the General Electric Company has not hesitated to design special apparatus for the electrical laboratory and shop. Among such special equipment may be mentioned the switchboards both for engineering and physics laboratories, special industrial control panels for A-C. and D-C. service, the AHI synchronous motor (or generator), and the 5 kw. rotary converter.

Thus the student is given an opportunity, while becoming familiar with the underlying principles of electrical engineering, to become acquainted with actual construction details. Bulletin GEA-1185B which has been recently revised, illustrates and describes G-E apparatus particularly adapted for laboratory use.

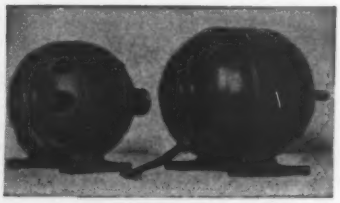
Selection of Electrical Shop and Laboratory Equipment

When deciding on the equipment for an electrical shop or laboratory, Bulletin GEB-62A will be particularly useful. In this booklet will be found listed in six different groups, equipment to meet a wide range of requirements. For the elementary courses a few of the more important types of machines are recommended, together with control apparatus, measuring instruments, and certain machine tools which should be in every electrical shop. For more advanced work, or as funds become available, equipment from other groups may be added to provide well balanced laboratory equipment which will permit a particularly wide range of experiments.

In addition to listing the equipment, this booklet discusses briefly the several items, explaining why they have been selected and the use to which they may be put in the laboratory.

Shop Projects

The General Electric Company, in carrying out its elaborate educational program, has sponsored the preparation and publication of several construction projects for technical and vocational schools. These projects are exceptionally valuable for the school shop due to the fact that they are not merely assembly projects but involve a certain amount of mechanical dexterity with such tools as the lathe, drill press, tap and die, etc. The projects already issued and available without charge cover:



Educational Projects. ¼ H.P. and ⅓ H.P. Motors.

1) ¼ H.P. Single-Phase, 60 cycle, 110 volt motor Bulletin GES-909
2) ½ H.P. Single-Phase, 60 cycle, 110/220 volt motor Bulletin GEA-2140A
3) ¾ H.P. 3-Phase, 60 cycle, 110 volt motor Bulletin GEA-2138
4) 1½ kw. 220-110/55 volt, single-phase, air-cooled transformer Bulletin GET-569

Kits for these projects can be purchased from the General Electric Company. In addition, complete instructions are given for the securing of any equipment that may not be included in the kit.

(Continued from page 46A)

Tubing — flexible nonmetallic, ¼ in. and ⅜ in.
Rectifiers — Tungar, for charging from 1 to 12, 6- and 12-volt batteries
Relays — Dixie
Resistance Boards — for testing
Rheostats
a) Compression, 275-watt
b) Field, for shunt and compound motors
Rotary Converter — 5-kw. capacity, 3-phase a.c., 110-volt d.c.
Speed Counters — 0–9999
Spring Balances — 0–30 lb.
Starting Boxes
a) For compound motors, various makes
b) For shunt-wound, 1 h.p., 110-volt motors. Overload release
c) For shunt-wound, 1 h.p., 110-volt motors. No voltage release
d) Starting devices of various makes and principles, for 1 h.p., 3-phase, 220-volt a.c. motors
Storage Batteries — 6-volt
Switchboard — as required
Telegraph Sets — including sounders, keys, and relays
Telephones
a) Complete bridging, independent phones
b) Couch vestibule telephones
c) Receivers, transmitters, induction coils, condensers, and bridging switch hooks
Transformers
a) Bell-ringing, 6-, 8-, 14-volt
b) Single-phase, 110–220-volt, S.K.V.A.
Washers
a) Iron, ¼ in. and ⅜ in.
b) Brass, ¼ in. and ⅜ in.
Wire
a) Annunciator No. 18 or No. 20
b) Fixture, No. 18, single yellow, with marker
c) Rubber covered, solid copper, No. 10, black
d) No. 10, white
e) No. 14, black
f) No. 14, white
g) Rubber covered, No. 16, brewery cord
h) No. 18, lamp cord, green and yellow
j) S.C.C. copper magnet, enameled, sizes Nos. 16 to 26 inclusive

Electrical Shop—Motor and Testing Equipment

Annunciators
a) Automatic needle-drop
b) Gravity-drop
c) Manual needle-drop
Armatures — burnt-out, for repairing
Battery Charger — commercial
Circuit Breakers
a) Air, single-pole, overload, 25-amp., 550-volt
b) Air, single-pole, underload, 15-amp., 550-volt
Controllers
a) For multiple-speed motor
b) For 1-h.p., 110-volt series motors
Generators
a) Motor-generator set, 10-h.p., to supply 110-volt d.c. for testing purposes, battery charging, etc.
b) Generator, 6-volt d.c., coupled to an a.c. motor for 6-volt circuit testing
c) Auto generators of different makes
Gravity Cells
Magnets — testing, 10,000-ohm
Meters
a) Ammeter, standard, 60-amp., a.c.
b) Ammeter, standard, 60 amp., d.c.
c) Ammeter, student, 60-amp., a.c.
d) Ammeter, student, 60-amp., d.c.
e) Voltmeter, standard, 0–10-volt, d.c.
f) Voltmeter, standard, 110–220-volt, d.c.-a.c.
g) Voltmeter, standard, 125-volt, a.c.
h) Voltmeter, standard, 125-volt, d.c.
j) Voltmeter, student, 110-volt, d.c.
k) Voltmeter, student, 110-volt, a.c.
l) Wattmeter, standard, 110–220-volt, 30–60-amp., d.c.-a.c.
m) Wattmeter, student, 110–220-volt, 30-amp., a.c.-d.c.
n) Watt-hour meter, 125-volt, 5 amp., a.c., single-phase, various makes
Motors
a) Auto starter, different makes
b) Burnt-out, fractional h.p., 110-volt, 60 cycle, for repairing
c) Compound, 1-h.p., 110-volt, d.c.
d) Multiple-speed, 1-h.p., 3-phase, 220-volt
e) Series, 1-h.p., 110-volt, d.c.
f) Shunt, 1-h.p., 110-volt, d.c.
g) Split-phase and repulsive, a.c., 110-volt, single-phase, assorted
k) Split-phase induction motors, fractional h.p., 110-volt, 60-cycle, different makes
j) 3-phase, 1 h.p., a.c., 220-volt, various makes
k) 3-phase, 2 h.p., 220-volt, a.c., various makes
l) Universal, fractional h.p., 110-volt, different makes
m) Universal, variable-speed, ½ h.p.
Platform Scale — 100-lb. capacity

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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Vol. 25
No. 3

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CONTENTS

A Survey of Drafting-Room Practices, *by F. R. Kepler*..... 71

A Responsibility of the Industrial-Arts Teacher, *by Thomas Diamond* 78

Industrial Arts Meets the Challenge, *by Frederick James Moffitt* 81

The Three Degrees in Industrial Education, *by Dr. Homer J. Smith* 85

Maintenance Man of Real Property, *by Edward C. Galligan*.... 88

Artistic Wrought-Iron Work — V, *by C. Weiler and Karl Ufer*.. 89

Editorials 90

Supplement

Artistic Wrought-Iron Work — V, *by C. Weiler and Carl Ufer* ..... No. 324

Problems and Projects

Modernistic Smoking Stand, *by Lawrence E. Wolske*..... 91

Brass Candlesticks, *by Emanuel E. Ericson*..... 91

Sunrise Memorandum Pad, *by Hazel F. Showalter*..... 92

Using Liquid Moth Exterminator in Upholstered Furniture, *by Herbert Bast*..... 93

Seas-O-Tainer, *by Dale E. Mansperger*..... 93

Indian Beadwork, *by W. Ben. Hunt*..... 95

How to Make Rawhide, *by W. Ben. Hunt*..... 96

Zipper Brief Case, *by Ross C. Cramlet*..... 97

Medicine Cabinet, *by John J. Metz and Pete Dillman*..... 99

Posters

Knowing the Objective, *by Louis M. Roehl*..... 97

Accuracy, *by Louis M. Roehl*..... 98

Personal News..... 100

Association News..... 100

School-Shop Equipment News 13A

New Publications..... 15A

DATES TO BE REMEMBERED

There are several conventions scheduled for the months of March and April which will be of special importance to all interested in industrial arts and vocational education. Among these are the following: Indiana Industrial Education Association, at Fort Wayne, Ind., March 27 and 28; Western Arts and South Eastern Arts Associations, at Nashville, Tenn., April 1 to 4; Eastern Arts Association, at New York City, April 15 to 18; Michigan Industrial Education Association, at Jackson, Mich., April 23 to 25.

THIS MONTH'S COVER

The picture chosen for this month's cover of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is a photograph in which Margaret Bourke-White portrays in excellent detail just how aluminum pigs are cast. Photograph, Courtesy Aluminum Company of America.

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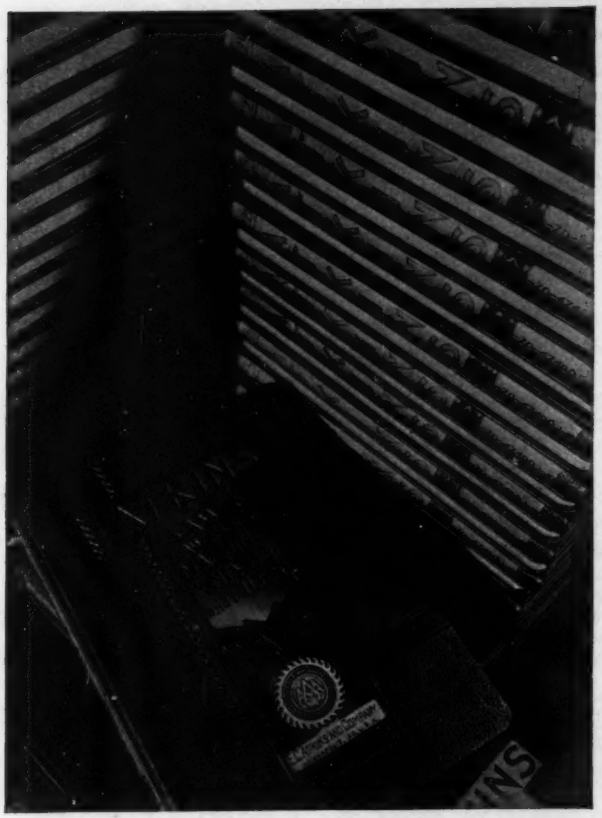
1936 CATALOG



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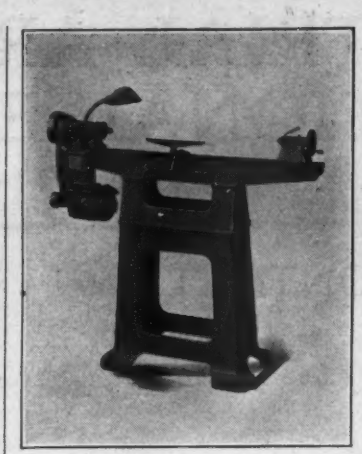

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